Hospital End-Use Market Assessment

Project Number ET23SWG0004

GAS EMERGING TECHOLOGIES PROGRAM (GET)

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CONTENTS

Acknowledgements iii

Disclaimer iii

Abbreviations and Acronyms iv

Executive Summary 1

Introduction 2

Assessment Objectives 2

1.0 Literature Review 3

- 1.1 ASHRAE Hospital Energy Efficiency Design Guidelines 4
- 1.2 Statewide Deemed Measures of Hospitals –eTRM 8
- 1.3 Prior program participation data (CEDARS) 10
- 1.4 Hospital EE Codes and Standards in California 19
- 1.5 Hospital Barriers Identified from the Literature Review 19
- 1.6 Hospital Retrocommissioning 20

2.0 Survey Tool and Hospital Screening Efforts 21

3.0 Site Visit Summary 21

- 3.1 Hospital Building Information Summary 21
- 3.2 Site Visit and Interviews 22
- 3.3 Hospital Gas Appliance Summary 22
- 3.4 Measure Participation 25
- 3.5 Hospital Barriers and Drivers Survey Summary 25
- 3.6 Observations and Discussion from Survey Results 29

Recommendations 31

Conclusions 32

Appendix 1. Hospital Benchmarking Data 33

Appendices 55

- Appendix 2.0 CEDARS Data Collection 55
- Appendix 3.0 Survey Tool 56
- Appendix 4.0 Hospital Site Visit and Interview Data 62

References 94

LIST OF TABLES

Table 1.0 Hospital Recommendation Table: Cooking Equipment [6] 5

Table 2.0: Hospital Recommendation Tables: Service Water Heating and Heating Systems [6] 7

Table 3.0: Zone 3 Recommendations for Surgical and Nonsurgical Use 8

Table 4: List of Hospital Applicable Deemed Measures 9

Table 5: 2020 Hospital Program Participation Table 10

Table 6: 2021 Hospital Program Participation Table 11

Table 7: 2022 Hospital Program Participation Table 11

Table 8: Yearly Net Therm savings per year 12

Table 9: Number of Yearly Projects according to each measure 13

Table 10. Measure Delivery Type 17

Table 11. Hospital Building Data 21

Table 12. Boiler Summary 22

Table 13. Water Heater Summary 23

Table 14. Ovens 24

Table 15. Fryer 24

Table 16. Gas Cooktop/Hot Plate/Gas Griddle 24

Table 17. Percentage of Hospital Gas Equipment that Meet the DEER EUL 25

Table 18. Survey Results Table 29

LIST OF FIGURES

Figure 1.0 Fuel use per building end-use and activity 3

Figure 2.0 California Climate Zones from 2021 International Energy Conservation Code data [5] 5

Figure 3.0 Graph of Measure Savings from 2020-2022 14

Figure 4.0 Graph of Hospital Projects over the years 15

Figure 5.0 Total number of hospital projects 16

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Abbreviations and Acronyms

Abbreviations and Acronym Heading	Abbreviations and Acronym Heading
Greenhouse Gas	GHG
Commercial Building Energy Consumption Survey	CBECS
Energy Efficiency	EE
Investor-Owned Utilities	IOUs
Subject Matter Expert	SME
California Energy Commission	CEC
Food Service Technology Center	FSTC
California Energy Data Reporting System	CEDARS
Electronic Technical Reference Manual	eTRM
Health Care Access and Information	HCAI
Office of Statewide Health Planning and Development	OSHPD
Original Equipment Manufacturer	OEM
Effective Useful Life	EUL
Centers for Medicare and Medicaid Services	CMS

Executive Summary

The Gas Emerging Technologies (GET) program conducted a market study to better understand gas technologies used in California hospitals and provide actionable recommendations for improving energy efficiency in hospitals.

The first step of the market study was to conduct a literature review. The literature search found that over 138 hospital buildings or 38% of hospitals had an ENERGY STAR rating below 50 and the total amount of natrual gas consumed by California hospitals in the year 2021 was 10.9 billion kBTU. The literature review also consisted of researching hospital energy efficiency guides, applicable hospital codes and standards, as well as hospital statewide deemed measures, and barriers. This study recommends hospitals follow the ASHRAE Guide for Large Hospitals as a technical resource for hospital equipment upgrades and energy savings. A review of hospital measures and prior program participation data found that most of the largest annual gas savings were seen in hot water and space heating projects, followed by food service. Based upon interviews, there is significant room for improvement in terms of hospital education and participation in energy efficiency (EE) programs.

The literature review also identified barriers such as a financial divide between some of the top for-profit hospitals versus smaller government and local hospitals which lack the financial resources to support energy efficiency improvements. Other barriers include a lack of communication on best EE practices across the state hospitals, lack of hospital personnel to keep track of EE programs and improvements, regulatory barriers, structural and operation barriers, and lack of top-down pressure from hospital executive and corporate management.

Site vists were conducted during this study to better understand existing hospital gas equipment and to survey facility mangers. A total of three hospital facility managers and directors agreed to a site visit and two hospital facility directors/consultants offered insight as subject matter experts. While this survey was limited due to lack of interested participants, site visit data indicated that most existing gas equipment were older than the DEER EUL lives and a majority of water heaters and boilers were over 40+ years old, which evidenced lives that were double the DEER EUL assumptions. Site visit data indicated that ASHRAE recommendations were not always followed for hot water heating set point temperatures. Most of the commercial cooking gas appliances surveyed from these hospitals were not ENERGY STAR compliant, and facility leaders did not recall being approached by a gas utility to particpate in an energy savings program.

The hospital site visits and surveys confirmed the literature review findings that regulatory issues were a significant problem for obtaining permits to replace existing equipment. Each

facility surveyed had varying levels of concern for decarbonizing the hospital building and this was related to top-down pressure from the executive level. Facility leaders agreed that the hospitals budget for EE improvements were often times a barrier, and departments generally run lean which makes it difficult to spend time and money on gas appliance updgrades when the priroity is improving equipment that is directly related to patient care. Facility leaders also cited challenges working with HCAI when seeking to upgrade gas equipment.

Based on the literature review and conversations with hospital facility leaders, this market study strongly recommends increased collaboration between EE programs and regulatory agencies such as HCAI and IOUs to help mitigate some of the permitting and regulatory problems that hospitals face when trying to replace equipment. In certain hospitals, executive leadership needs to be more supportive of EE improvements and prioritize training facility teams on updated EE gas equipment and best practices for optimizing EE. Hospital retrocommissioning is encouraged and recommended in order to understand the best opportunities for equpiment retrofits in each hospital. Additional measures and increased incentives for newer gas technologies and upgrades such as Ultra Low NOx Burners and Natual Gas Heat Pumps should be developed and included in EE programs.

Introduction

Hospitals represent the second most aggregate energy intensive building type behind commercial food service. As much as 50% of energy used in hospitals is for space heating, and water heating. Additionally, the health care industry accounts for 10% of the total greenhouse gas (GHG) emissions from buildings in the United States [1]. Data from the Commercial Building Energy Consumption Survey (CBECS) found that large hospitals in the United States consumed over 208 trillion BTU's of natural gas alone in 2007. Hospital buildings also have a massive environmental footprint and generate over 8% of the country's greenhouse gas emissions. Thus, the need to decarbonize hospitals is important in order to address climate change impacts.

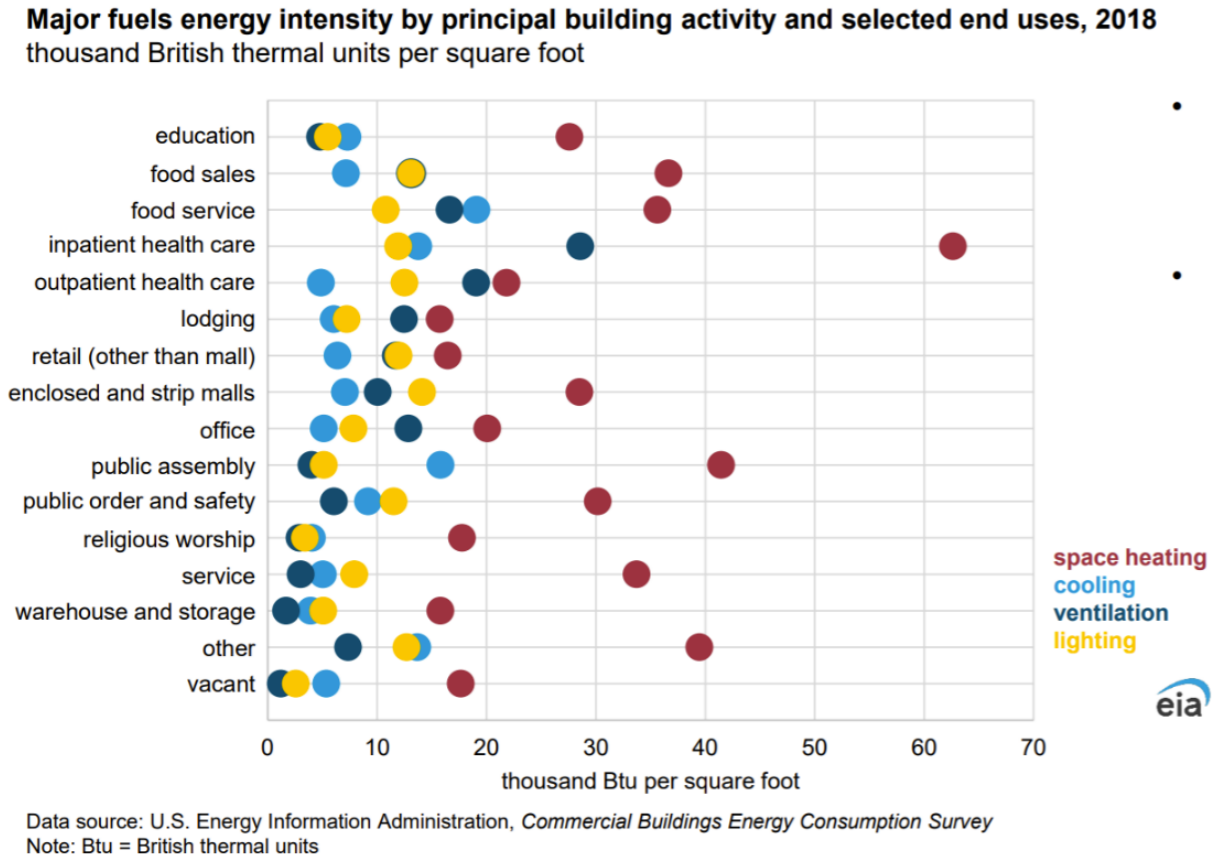
Assessment Objectives

The primary objective of this market study is to conduct a literature review on hospital Energy Efficiency (EE) guides, journals, case studies, and investigate prior program participation data including statewide deemed measures for hospitals in California. Another objective of this study was to conduct hospital site visits to gather data on current hospital gas equipment and obtain feedback from hospital facility managers on types of barriers and program participation data. The report will ultimately provide hospitals and investor-owned utilities (IOUs) with updated market data and recommendations related to hospital gas equipment.

1.0 Literature Review

According to the U.S. Bureau of Labor Statistics, California has a total of 355 hospitals as of 2021, most of which operate on a 24-hour basis [2]. In the United States, healthcare buildings are the second largest consumer of energy per unit of floor area of building type [3]. The U.S. Energy Information Administration, CBECS Survey in 2018 found that inpatient health care was among the most energy intensive buildings with space heating being the most energy intensive for inpatient health care buildings [4].

Figure 1.0 Fuel use per building end-use and activity



The California Energy Commission (CEC) Building Energy Benchmarking Program from 2021 provides a list of all building types and their energy use data. This file was downloaded from the CEC, and a pivot table was created that filtered out only healthcare facilities by the following names:

- Ambulatory Surgical Center
  - Hospital (General Medical and Surgical)
  - Medical office
  - Urgent Care/Clinic/Other Outpatient

Some major hospitals fell under one of four categories mentioned above, and some hospitals with multiple buildings had several entries as opposed to one entry for the entire hospital campus. The pivot table generated a list of California hospitals along with their energy usage including Natural Gas Use (kBtu), and the ENERGY STAR score, which is summarized in order of greatest natural gas use per building square feet (KBtu/ft^2) to the least in Appendix 1.0. Note that as of August 2023 when the literature review was conducted, the data from the 2022 building energy benchmarking program had not yet been uploaded.

From the Building Energy Benchmarking data, a total of 138 buildings within hospital campuses had an ENERGY STAR rating of below 50 and below. An ENERGY STAR building score of below 50 means that those hospitals have poorer overall energy efficiency and potentially higher greenhouse gas emissions compared to 50% of similar buildings that size. Note that the table also displays electricity use since the ENERGY STAR rating takes into account both gas and electric uses. Additionally, the total amount of natural gas consumed by California hospitals during the year 2021 was 10 billion kBTU.

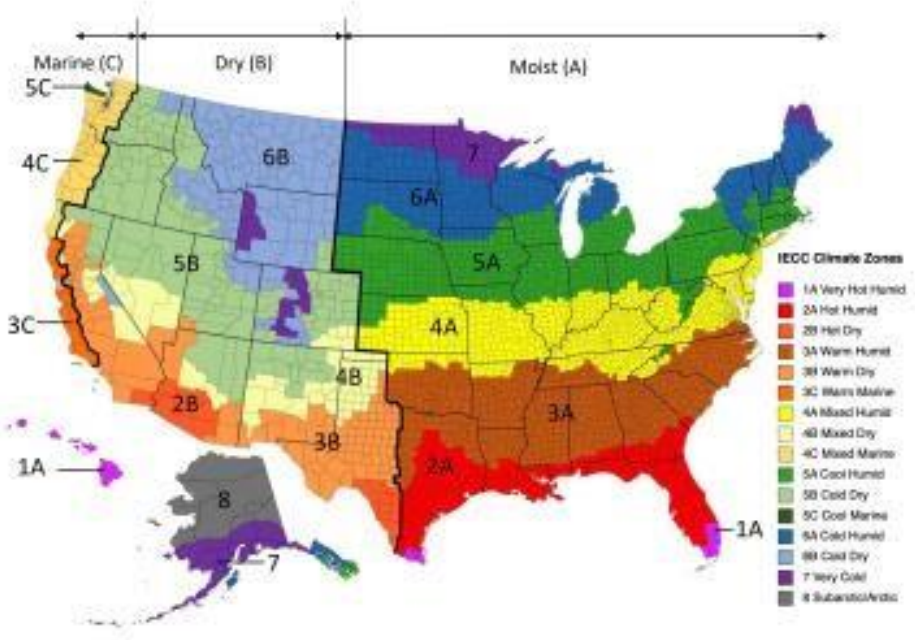
Identifying energy inefficiencies in hospitals can be complex, as hospitals have intense energy use demands associated with space heating, domestic and service hot water heating, steam, cooking equipment, and drying. This literature review focused on natural gas related energy end-use consumption for California hospitals, including a review of energy efficiency guides, hospital energy codes and standards, hospital statewide deemed measures, barriers, and new energy efficient natural gas hospital technologies.

1.1 ASHRAE Hospital Energy Efficiency Design Guidelines

Two ASHRAE hospital energy guide manuals were reviewed to best understand the energy demands and best practices of hospital end-use equipment. The advanced energy design guide for large hospitals is a publication designed to provide strategies and recommendations for achieving 50% energy savings over the minimum code requirements of ANSI/ASHRAE/IESNA Standard 90.1-2004. This guide contains recommendations to design a low-energy-use building. In general, most large hospitals are at least 100,000 ft^2. The literature search also looked at other ASHRAE design handbooks for smaller hospitals, which provided similar recommendations. The literature review found that the ASHRAE guide for large hospitals encompasses all the key savings listed and was the primary resource for the hospital equipment savings mentioned below.

Different recommendations for energy efficient hospital equipment are listed in the ASHRAE guides based on the International Energy Conservation Code (IECC) climate zone. Figure 2 shows that a majority of California is categorized as having a zone 3 climate, with a few counties in zone 4 and zone 5. This literature review will focus on energy efficiency recommendations listed under IECC climate zone 3.

Figure 2.0 California Climate Zones from 2021 International Energy Conservation Code data [5]



Cooking Equipment

The following recommendations for energy efficient cooking equipment in hospitals are listed below, along with ASHRAE written "how-to" guidelines to implement these suggestions. Note that electric appliance components and recommendations were a sizable part of these ASHRAE guides, however this literature review focused on gas appliances and its corresponding recommendations and guidelines.

Table 1.0 Hospital Recommendation Table: Cooking Equipment [6]

Component	Recommendation	"How to" Guidelines (See below)
Cooking Equipment	ENERGY STAR or California rebate-qualified equipment	PL 8-9

PL8- This guideline is intented for most large hospitals which are designed with a complete cooking kitchen and a full cafeteria. A typical hospital kitchen includes significant refrigeration equipment, such as a walk-in freezer, walk-in cooler, ice machine, and pass-through refrigerators. Opportunities to conserve energy include the following:

- Select cooking appliances that reduce radiant heat loss to the kitchen by eliminating high-heat producing appliances, such as broilers, griddles, ranges, and replacing

them with combination oven-steamers (combination ovens), tilting skillets, convection ovens, microwaves, or appropriate lighter-duty appliances.

- Select appliances that minimize idle energy use
- Select exhaust-hood styles that reduce exhaust air and makeup airflow
- Select walk-in freezers and coolers with high-performance thermal envelopes and refrigeration systems. The refrigeration system should comply with Section 312 of the Energy Independence and Security Act of 2007 [6]
- Select ENERGY STAR equipment as a minimum standard for designs that include any of the eight appliance categories currently available. For other categories refer to publications from the Consortium of Energy Efficiency and the Food Service Technology Center (FSTC) [6]

PL9- Energy efficient cooking equipment

- Hospitals should elect energy efficient appliances including dishwashers, solid-door freezers, fryers, hot-food heating cabinets, ice machines, refrigerators, and steamers.
- Select low-flow hot-water fixtures to minimize both water and energy use
- This guide recommends visiting the commercial kitchen initiative (CKI) and ENERGY STAR websites which provide good lists of efficiency strategies and ENERGY STAR rated commercial kitchen equipment [6].
  - A number of resources are available from the FSTC with links and guidance on efficient design for commercial kitchens.
  - FSTC is the industry leader in commercial kitchen energy efficiency and appliance performance testing and has developed over 35 standard test methods for evaluating commercial kitchen appliance performance.

PL10 – Exhaust and Ventilation Energy use

- The guidelines suggest designing exhaust ventilation systems with proper layout of cooking equipment and proper hood design to minimize total airflow while still providing sufficient exhaust flow [6].
- After minimizing ventilation needs, hospitals should consider variable-speed exhaust hood flow systems.

Water Heating

Table 2 describes the water heating requirements to optimize EE in hospitals according to the ASHRAE Energy Design Guide for Hospitals. Note that there are some emerging technolgies such as gas absoprtion heat pump water heaters that may be applicable as well and are not expictally called out by the ASHRAE guide.

Table 2.0: Hospital Recommendation Tables: Service Water Heating and Heating Systems [6]

Component	Recommendation	"How-to" Guidelines (See below)
Gas water heating (condensing)	95% efficiency	Wh3 HV8
Gas Point-of-use water heater	0.81 Ef or 81% Ef_t	PL11, WH3
Electric-heat pump water heater	2.33 EF	WH3
Pipe insulation	1.0 in./1.5in.	WH7
No central steam, use hot-water distribution system	Point-of-use steam for humidification and sterilization	HV33

PL11 Minimize Hot-water use

- The FSTC publishes a hot-water system design guide for commercial kitchens that provides key information on how to achieve superior performance and energy efficiency
- Some examples, include incorporating "free heating" technologies such as waste heat recovery and solar preheating
- Hospitals should also focus on increasing the efficiency of hot water delivery performance

WH3 Systems Descriptions

Gas-Fired Storage Water Heater: Standard heater efficiencies are typically 80%, however rated efficiencies of at least 95% are recommended. An electronic ignition is recommended to avoid energy losses from a standard pilot [6].

Gas-Fired Instantaneous Water Heater: An electronic ignition and either a flue gas damper or fan-forced combustion are recommended to avoid the energy losses from a standard pilot and exfiltration due to stack effect. A minimum rated efficiency of 95% is recommended.

Heat pump water heater: These units use a heat pump to heat water and simultaneously cool either the air around the heater or the fluid in a piping system. Depending on the heating water reset schedule, it is usually most efficient to preheat the domestic water to a temperature somewhat below the heating water temperature and complete the heating process with a gas-fired heater [6].

HV8 Cooling and Heating Equipment Efficiencies

Heating equipment should meet or exceed the efficiency levels listed in the recommendation Table 2 above.

WH7: Pipe Insulation

This recommendation requires that all service water heating piping should be installed with accepted industry standards. Recommended insulation is between 1.0 in to 1.5 in diameter.

HV33 Elimination of Steam Boilers

Steam boilers were often used by hospitals in the past. Uses included humidification, sterilization, and preheating very cold outdoor air without concern of freezing the preheat coil. Steam boilers and their systems have several disadvantages including the following:

1. Producing steam at high temperatures and then reducing the temperature at the load leads to inefficiency
2. The maintenance of steam systems, including steam traps, requires significant time and cost. Using hot-water systems can lead to maintenance cost reductions of up to 75%.

Table 3.0: Zone 3 Recommendations for Surgical and Nonsurgical Use

Component	Recommendation	"How-to" Guidelines
Boiler efficiency	90% Ef_c	HV8

HV8 Cooling and Heating Equipment Efficiencies

As stated above, heating equipment should meet or exceed the efficiency levels listed in the recommendation table above. Thus, boilers should be operating at greater than 90% efficiency.

Overall, the ASHRAE guidelines for hospitals focus on water heating, space heating, and cooking equipment for optimizing hospital gas savings and improving energy efficiency. While this literature review did not focus on electric savings from the ASHRAE guides, these can be addressed separately. The ASHRAE recommendations appear to support the California EE program measures explored in the next section.

1.2 Statewide Deemed Measures of Hospitals –eTRM

The California Energy Data Reporting System (CEDARS) data was used to find program participation data from the past three years. Hospital measures in CEDARS were cross referenced with measure information from California's electronic Technical Reference Manual (eTRM), to verify the gas savings potential of the measure and double check its

applicability for hospitals. The relevant measures listed below in Table 4 are all deemed measures. Custom hospital measures did not show up in the CEDARS data when sorting through the healthcare building types, so it is unclear if they would show up in a different category or if COVID impacts stopped most customer project devleopment.

Table 4: List of Hospital Applicable Deemed Measures

Measure ID	Measure Description
SWPR003	Steam Trap, Commercial
SWPR007	Steam Boiler Economizer
SWHC004-05	Space Heating Boiler, Commercial & Multifamily
SWHC011-02	Furnace, Commercial
SWHC013-03	Unitary Air-Cooled Air Conditioner, Over 65 kBtu/hr, Commercial
SWHC014-03	Unitary Air-Cooled Air Conditioner or Heat Pump, Under 65 kBtu/hr, Commercial
SWSV005-02	Economizer Repair, Commercial
SWSV010-02	Economizer Controls, Commercial
SWWH004-03	Laminar Flow Restrictor, Commercial
SWWH005-06	Boiler, Commercial
SWWH007-05	Storage Water Heater, Commercial
SWWH006-07	Tankless Water Heater, Commercial
SWFS001-03	Convection Oven, Commercial
SWFS002-03	Door-Type Dishwasher, Commercial
SWFS003-03	Combination Oven, Commercial
SWFS005-03	Steamer, Commercial
SWFS011-05	Fryer, Commercial
SWWH017-04	Hot Water Pipe Insulation, Nonresidential and Multifamily
SWWH018-04	Hot Water Tank Insulation, Nonresidential and Multifamily
SWFS013-02	Low Flow Pre-rinse spray valve
SWWH020-04	Low-Flow Showerhead, commercial
SWWH019-04	Faucet Aerator, Commercial
SWFS018	Under Counter Dishwasher, Commercial

1.3 Prior program participation data (CEDARS)

In general, EE programs help drive the adoption of different and more efficiecnt technologies. Various EE programs can help the customer save money by minimizing gas energy use, while still meeting their needs. Appendix 2.0 summarizes the steps that were taken to gather program and efficiency data for hospitals from 2020-2022.

Table 5 lists the measures, yearly net therm savings, and number of units installed for all hospital deemed measures in 2020. Note that the number of units installed does not always refer to a single install, some units especially for hot water and space heating measures document this in terms of kBtu. The correct units are specified under the number of units installed column for Tables 5-7.

Table 5: 2020 Hospital Program Participation Table

Measure Description	First Year Net Therm	Number of Units Installed (each, kbtu, Cap-Tons, Ln-ft)	Project Count
Combination Oven, Commercial	519	1 each	1
Convection Oven, Commercial	660	5 each	
Enchanted Ventilation for Packaged HVAC	612	30 Cap-Tons	6
Faucet Aerator, Commercial	38	25 each	1
Fryer, Commercial	269	1 each	1
Hot Water Pipe Insulation, Nonresidential and Multifamily	321	65 Ln -ft.	4
Hot Water Tank Insulation, Nonresidential and Multifamily	23,447	2,488 kBtu	20
Laminar Flow Restrictor, Commercial	10,602	815 kBtu	27
Low-Flow Pre-Rinse Spray Valve	61	6 each	4
Low-Flow Showerhead, Commercial	749	175 kBtu	10
Space Heating Boiler, Commercial & Multifamily	6,157	11,600 kBtu	17

*Note that "each" refers to the number of units installed per measure per year and is not related to the project count

* The first year net therm savings are the totals for each measure

Table 6. lists the measures, yearly net therm savings, and number of units installed for all hospital deemed measures in 2021.

Table 6: 2021 Hospital Program Participation Table

Measure Description	First Year Net Therm	Number of Units Installed (each, KBtu, Ln-ft.)	Project Count
Boiler, Commercial	9,447	25,200 kBtu	20
Convection Oven, Commercial	3,030	86 kBtu	49
Door-Type Dishwasher, Commercial	120	4 each	4
Fryer, Commercial	1,732	25 each	21
Hot Water Pipe Insulation, Nonresidential and Multifamily	90,820	3,777 Ln-ft.	16
Laminar Flow Restrictor, Commercial	1,481	179 kBtu	12
Space Heating Boiler, Commercial & Multifamily	4,446	3,000 kBtu	2
Steamer, Commercial	1,645	8 each	8
Tankless Water Heater, Commercial	2,099	6,008 kBtu	8
Under Counter Dishwasher, Commercial	73	12 each	8

Table 7. lists the measures yearly net therm savings, and number of units installed for all hospital deemed measures in 2022.

Table 7: 2022 Hospital Program Participation Table

Measure Description	First Year Net Therm	Number of Units Installed (Each, kBtu)	Project Count
Boiler, Commercial	14,610	11,988 kBtu	12
Combination Oven, Commercial	728	4 each	4
Convection Oven, Commercial	2,111	64 kBtu	44
Door-Type Dishwasher, Commercial	125	4 each	4
Exhaust Hood Demand Controlled Ventilation, Commercial	131	8 each	8
Fryer, Commercial	1,101	16 each	16
Laminar Flow Restrictor, Commercial	21,162	1,480 kBtu	16
Space Heating Boiler, Commercial & Multifamily	31,058	119,944 kBtu	64
Steamer, Commercial	825	20 each	24
Storage Water Heater, Commercial	8,955	7,758 kBtu	40
Tankless Water Heater, Commercial	72,163	80,599 kBtu	88
UnderCounter Dishwasher, Commercial	59	8 each	8
Unitary Air-Cooled Air conditioner or heat pump, under 65 kBtu/hr, Commercial	43	156 kBtu	40

Table 8 summarizes the yearly net therm savings for each energy efficiency measure for the three year period.

Table 8: Yearly Net Therm savings per year

Hospital EE Measure	Yearly Net Therm Savings			
Measure Description	**2020**	**2021**	**2022**	**Total**
Boiler, Commercial		9,447	14,610	24,057
Combination Oven, Commercial	518	-	728	1,246
Convection Oven, Commercial	659	3,029	2,111	5,800
Door-Type Dishwasher, Commercial	-	120	125	245
Enchanted Ventilation for Packaged HVAC	611	-	-	611
Exhaust Hood Demand Controlled Ventilation, Commercial	-	-	131	131
Faucet Aerator, Commercial	38	-	-	38
Fryer, Commercial	269	1,731	1,101	3,101
Hot Water Pipe Insulation, Nonresidential and Multifamily	321	90,820	-	91,141
Hot Water Tank Insulation, Nonresidential and Multifamily	23,447			23,447
Laminar Flow Restrictor, Commercial	10,602	1,481	21,162	33,246
Low-Flow Pre-Rinse Spray Valve	61	-	-	61
Low-Flow Showerhead, Commercial	748	-	-	748
Space Heating Boiler, Commercial & Multifamily	6,156	4,446	31,057	41,660
Steamer, Commercial	-	1,644	825	2,470
Storage Water Heater, Commercial	-	-	8,954	8,954
Tankless Water Heater, Commercial	-	2,099	72,162	74,261
Under Counter Dishwasher, Commercial	-	73	59	132
Unitary Air-Cooled Air conditioner or heat pump, under 65 kBtu/hr, Commercial	-	-	42	42
Sum of Yearly Net Therm Savings	43,430	114,890	153,067	311,349

Table 9 is a sum of the total number of projects implemented over the three years for each energy efficiency measure.

Table 9: Number of Yearly Projects according to each measure

Hospital EE Measure	Approximate Yearly Number of Projects			
Measure Description	**2020**	**2021**	**2022**	**Total**
Boiler, Commercial	-	20	12	32
Combination Oven, Commercial	1	-	4	5
Convection Oven, Commercial	3	49	44	96
Door-Type Dishwasher, Commercial	-	4	4	8
Enchanted Ventilation for Packaged HVAC	6	-	-	6
Exhaust Hood Demand Controlled Ventilation, Commercial	-	-	8	8
Faucet Aerator, Commercial	1	-	-	1
Fryer, Commercial	1	21	16	38
Hot Water Pipe Insulation, Nonresidential and Multifamily	4	16	-	20
Hot Water Tank Insulation, Nonresidential and Multifamily	20	-	-	20
Laminar Flow Restrictor, Commercial	27	12	16	55
Low-Flow Pre-Rinse Spray Valve	4	-	-	4
Low-Flow Showerhead, Commercial	10	-	-	10
Space Heating Boiler, Commercial & Multifamily	17	2	64	83
Steamer, Commercial	-	8	24	32
Storage Water Heater, Commercial	-	-	40	40
Tankless Water Heater, Commercial	-	8	88	96
UnderCounter Dishwasher, Commercial	-	8	8	16
Unitary Air-Cooled Air conditioner or heat pump, under 65 kBtu/hr, Commercial	-	-	40	40
Sum of Total Projects	94	148	368	570

To better visualize the data from the tables below, a graph of each measures yearly net them savings was plotted and is shown below in Figure 3.0.

Figure 3.0 Graph of Measure Savings from 2020-2022

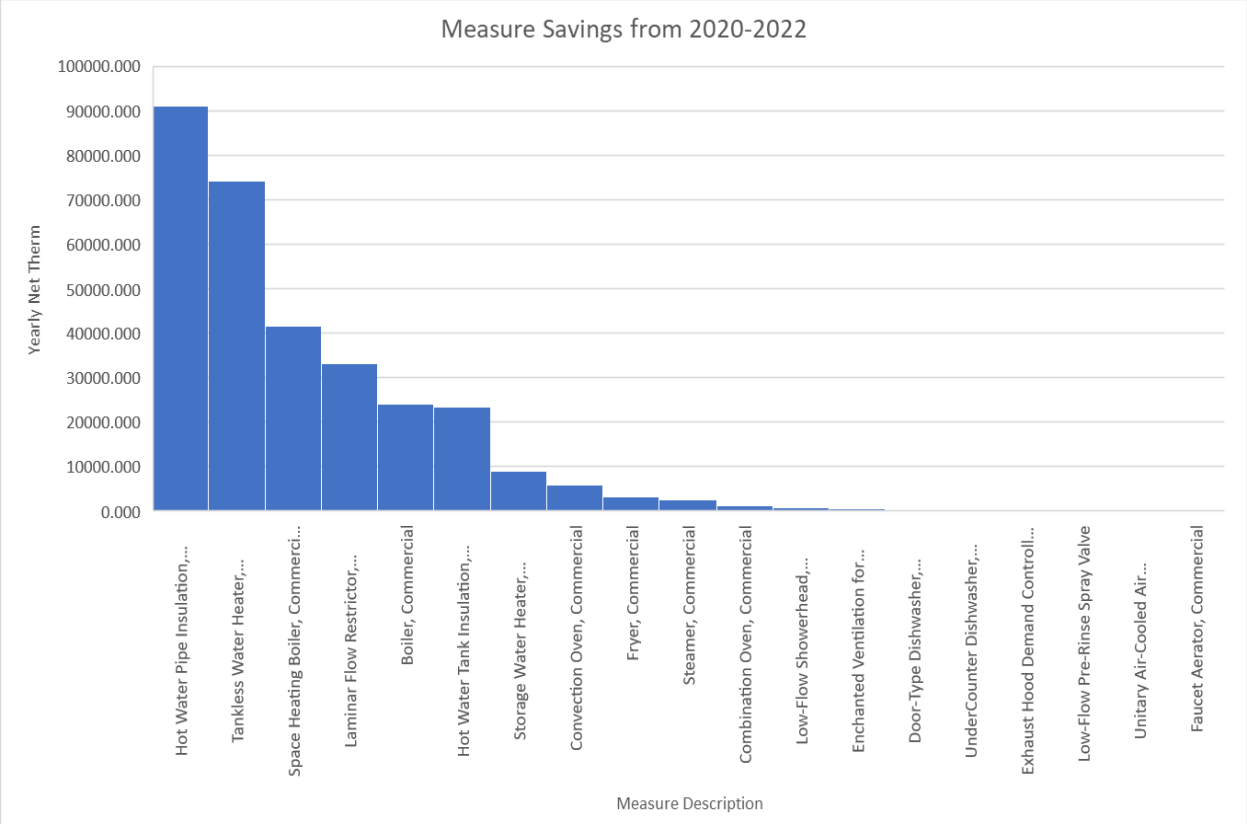
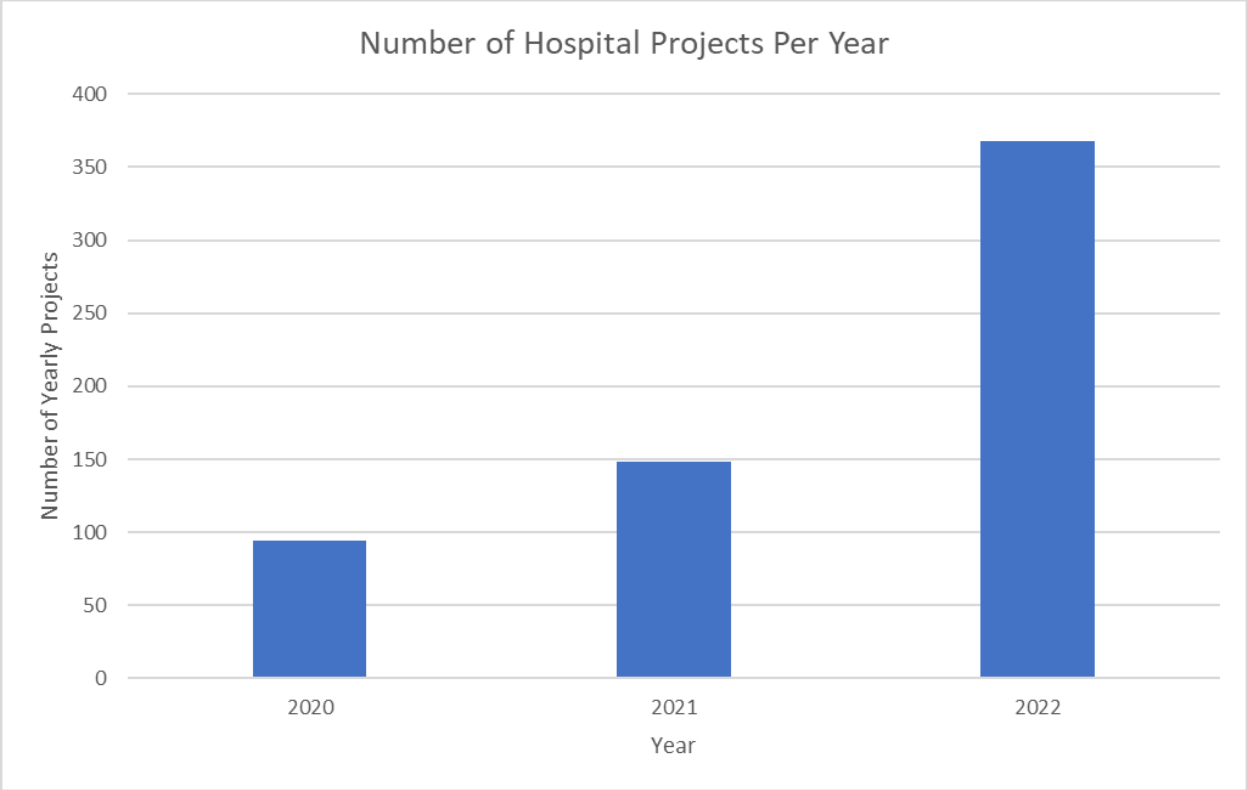


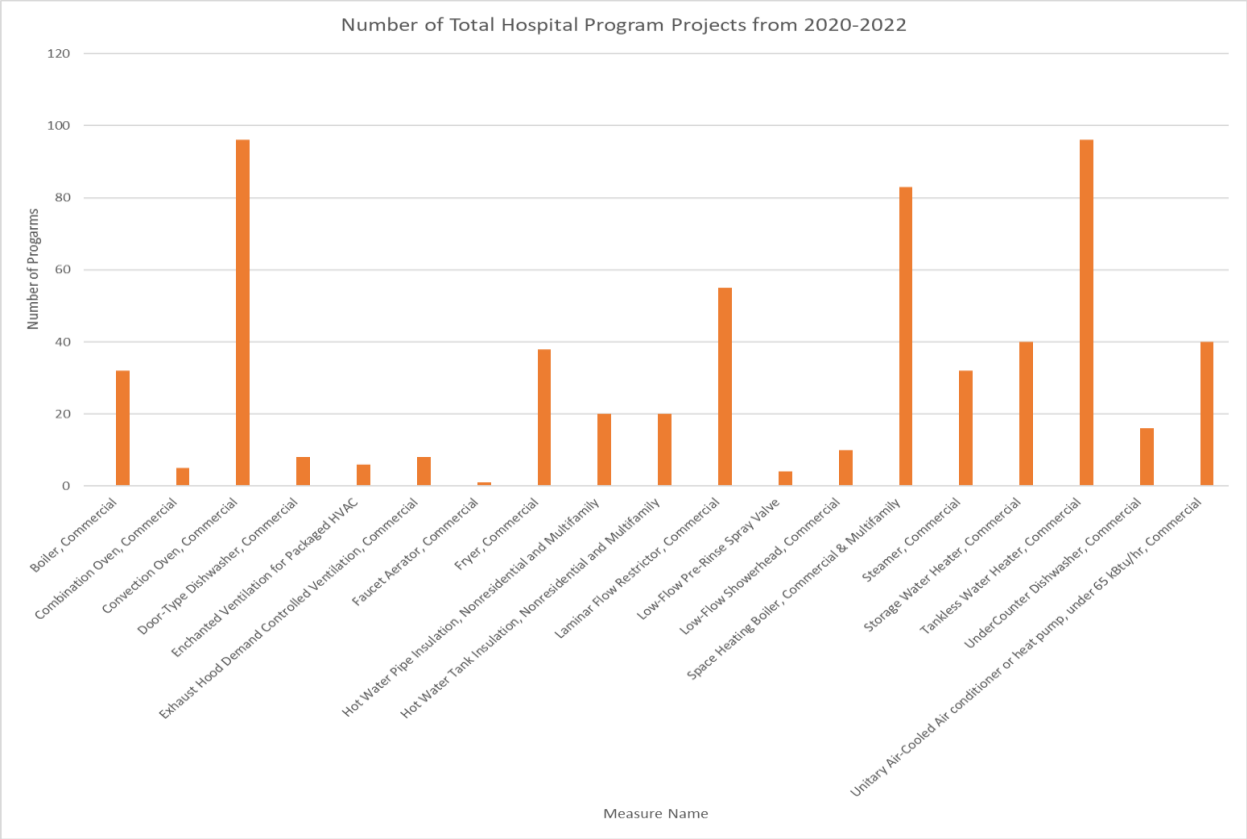
Figure 3.0 shows that the biggest annual gas savings were seen in hot water and space heating projects, followed by food service projects. The middle of the graph consists of mainly food service, convection oven, fryer, steamer, combination oven with moderate gas savings. Other measures such as, Low Flow Showerhead, Enchanted ventilation for packaged HVAC, Faucet Aerator, Low-flow Showerhead, Door Type Dishwasher, Under Counter Dishwasher, Exhaust hood dishwasher had minimal savings to offer, which indicates there may be opportunites to expand the use of these. To better understand the number of programs per year, a graph was plotted as shown in Figure 4.0.

Figure 4.0 Graph of Hospital Projects over the years



According to Figure 4.0, the number of yearly projects seems to have been impacted by the COVID-19 pandemic in 2020 and 2021. However, the hospital program participation seems to have picked up in 2022. The growth from 2022 presents a good opportunity over the next few years to ramp up EE projects in hospitals. A final graph, shown in Figure 5.0 was plotted to illustrate the number of total hospital projects over the three-year period based on each measure.

Figure 5.0 Total number of hospital projects



From this graph, the measures most adopted include the convection oven, laminar flow restrictor, space heating boiler, and tankless water heating. The data shows that water heating and space heating dominate the majority of programs, while the commercial food service aspect of hospitals seems to be lacking. When cross-referrencing Figure 5.0 with Figure 3.0, most of the measures that had lower net yearly terms savings also had lower program numbers. According to this data, the measures that appear underutilized in the hospital cooking sector include:

- Combination Oven
  - From the ASHRAE Hospital energy design guide, combination ovens were recommended in the place of broilers, griddles, and ranges.
- Door-Type Dishwasher
- Exhaust Hood Demand Controlled Ventilation
- Low-Flow Pre-Rinse Spray Valve
- Steamers
- Undercounter dishwasher
  - Note this may not apply to larger kitchens

We also noticed the lack of measures associated with "clothes drying". If some hospitals have in-house laundry for patient beds and other housekeeping needs, and this could be a potential opportunity to explore. From the eTRM, there exists a gas dryer modulating valve measure for commercial and multifamily usage that could be leveraged by hospitals to improve their gas savings. This measure provides savings by reducing high fire minutes per dryer load cycle by alternating between low and high rates. Prior studies found that a modulation valve produces a 12.4% reduction in natural gas consumed by a dryer [6]. From initial conversations with hospital representatives, some facilities have chosen to move their laundry services off site. Later site visits to hospitals confirmed that most hospitals have transitioned to off-site laundry facilities.

Other trends observed include:

- Tankless water heaters were adopted in hospitals more than storage water heaters. This trend was also observed in another study conducted by the GET program which focused on understanding the water heating market. The study, ET22SWG0001, found that commercial and residential tankless water heaters were well adopted compared to storage water heaters, even though they were more expensive.
- Convection ovens were adopted more than combination ovens
- Low-flow showerheads appear to be underutilized

Table 10 states whether the measure delivery type was downstream, midstream, or upstream. Generally, downstream delivery types involve customer involvement while midstream or upstream delivery types are carried out through an installer or manufactuer, thus the customer has little knowledge of this. This is important to consider in the next Section since many hospital facility leaders were not aware of these measure offerings, which could be attributed to upstream delivery types.

Table 10. Measure Delivery Type

Hospital EE Measure	2020 Measure Delivery Type (Downstream, Midstream, Upstream)	2021 Measure Delivery Type (Downstream, Midstream, Upstream)	2022 Measure Delivery Type (Downstream, Midstream, Upstream)
Boiler, Commercial	-	Upstream Deemed	Upstream Deemed
Combination Oven, Commercial	Upstream deemed	-	Upstream Deemed
Convection Oven, Commercial	Upstream deemed	Upstream Deemed	Upstream Deemed
Door-Type Dishwasher, Commercial	-	Upstream Deemed	Upstream Deemed
Enchanted Ventilation for Packaged HVAC	Downstream	-	-

Hospital EE Measure	2020 Measure Delivery Type (Downstream, Midstream, Upstream)	2021 Measure Delivery Type (Downstream, Midstream, Upstream)	2022 Measure Delivery Type (Downstream, Midstream, Upstream)
Exhaust Hood Demand Controlled Ventilation, Commercial	-	-	Upstream Deemed
Faucet Aerator, Commercial	Downstream	-	-
Fryer, Commercial	Upstream Deemed	Upstream Deemed	Upstream Deemed
Hot Water Pipe Insulation, Nonresidential and Multifamily	Downstream deemed direct install	Downstream deemed	-
Hot Water Tank Insulation, Nonresidential and Multifamily	Downstream deemed direct install	-	-
Laminar Flow Restrictor, Commercial	Downstream deemed & Downstream deemed direct install	Downstream deemed	Downstream Deemed
Low-Flow Pre-Rinse Spray Valve	Downstrem deemed direct install	-	-
Low-Flow Showerhead, Commercial	Downstream deemed direct install	-	-
Space Heating Boiler, Commercial & Multifamily	Downstream Deemed	Downstream Deemed	Downstream Deemed & Upstream Deemed
Steamer, Commercial	-	Upstream Deemed	Upstream Deemed
Storage Water Heater, Commercial	-	-	Upstream Deemed
Tankless Water Heater, Commercial	-	Upstream Deemed	Upstream Deemed
UnderCounter Dishwasher, Commercial	-	Upstream Deemed	Upstream Deemed
Unitary Air-Cooled Air conditioner or heat pump, under 65 kBtu/hr, Commercial	-	-	Upstream Deemed

1.4 Hospital EE Codes and Standards in California

The department of Health Care Access and information (HCAI), formerly known as the office of Statewide Health Planning and Development (OSHPD) provides codes and standards requirements for California hospitals. The Building Standards Unit under HCAI is responsible for the development of building standards for the construction of hospitals and licensed clinics in California.

Other codes followed by California hospitals include the Title 24 California Building Standards Code which outlines structural safety and sustainability requirements for buildings. These energy codes, in addition to the annual Title 20 Appliance Efficiency Regulations are updated by the CEC every three years.

Hospital equipment such as boilers must also be regulated by local Air Quality Management District's according to the federal Clean Air Act, which establishes requirements for cities and counties to meet specific emissions standards.

These various organizations impose limits on review, timeline, costs and some measures. For example, the laminar flow faucet measure was designed specifically for healthcare use to address HCAI requirements.

1.5 Hospital Barriers Identified from the Literature Review

Hospitals serve a complex and diverse group of critical care environments, and EE measures are often competing with other critical care infrastructure and investments (BTP). Additionally, smaller and rural hospitals can encounter financial challenges that prevent them from considering efficiency improvements. The financial divide between some of the top for-profit hospitals versus smaller governments and local hospitals exists as a barrier in terms of having the financial resources to participate in energy efficiency programs. According to the DOE, additional barriers include lack of communication on the best efficiency practices, lack of documented results to support the business case for efficiency, and lack of a more efficient equipment due to limited “demand pull” from the hospital market.

Another barrier that exists is the lack of hospital engineering personnel to apply for and keep track of EE programs. A study found that within the UCSD medical center, there was no formal group or system in place to monitor the hospital's energy consumption and analyze potential energy efficiency projects. Usually, investments in energy efficiency are typically needed in hospitals. If apiece of equipment fails, and needs replacement, that usually becomes the only opportunity for efficiency. The study at UCSD found that larger scale equipment overhauls typically only happen from planned hospital expansions. Additional barriers to energy efficiency at UCSD are summarized below [8]:

- Low Economic Incentives: Low energy prices for the campus do not create enough incentives for serious efficiency measures
- Structural/ Operational barriers: Hospitals have some sections running 24 hours a day which make maintenance and equipment upgrades difficult
- Regulatory Barriers: hospitals in California face strict seismic regulation, making some efficiency projects economically non-viable due to sizing restrictions
- Lack of Top-down Pressure: Lack of serious pressure on medical centers from the top of the organizational pyramid has failed to create a sense of urgency
- Insufficient Staff Capacity: The existing staff within the facility lack the time and resources to focus on EE measures.

This study reflects the barriers in just one out of the hundreds of existing California hospitals. These barriers are not unique to just this one hospital at UCSD, and further site visits have confirmed this and identified additional barriers across other California hospitals.

1.6 Hospital Retrocommissioning

The main natural gas EE opportunities for hospitals exist in the water heating, space heating, and commercial cooking sectors. Replacing older equipment or retrofitting an appliance can offer hospitals savings on their utility bills and operating costs.

Hospital retrocommissioning is a process by which hospitals can identify what appliance or fixture needs to be replaced or fine-tuned to improve its energy efficiency. In an ASHRAE Journal, it was documented that Mercy Hospital in Fort Scott, Kansas underwent a retro commissioning (RCx) effort which identified and evaluated approximately 130 energy cost reduction measures [9]. They found that opportunities to minimize energy consumption existed primarily in heating and cooling, in addition to control sequences. After changes were made, the Mercy Hospital had a 45.5% decrease in natural gas consumption and decreased its overall energy use by 40.6% [9]. Based on this data and other research, each hospital's needs are very different, and retrocommissioning is a great way to identify opportunities implementing new or retrofitted equipment. Note that the HCAI does not require commissioning for hospitals, however they fully understand the need to ensure that all systems work properly and efficiently in a hospital, which is why HCAI (formerly OSHPD) has developed the Test, Inspection, and Observation Program (TIO) [10]. The TIO Program covers testing required by applicable codes and shares some overlap with pre-functional commissioning checklists and functional performance testing. The major difference between code required testing and commissioning is the range of loads considered. Custom or Deemed projects focused on hospital retrocommissioning were not listed under the program participation data from 2020-2022 and was another gap identified in hospital facility manager interactions during the site visits.

OEM's likely have new or emerging technologies in water heating, space heating including energy efficient space heating and hot water boilers and ultra-low NOx burners that could be leveraged to retrofit older hospital equipment. Prior market studies conducted by the GET Program including the Boiler EE Measure Assessment, and the Ultra-Low NOx burner market study describe potential technology upgrades that would be suitable for commercial buildings like hospitals [11,12].

2.0 Survey Tool and Hospital Screening Efforts

A Survey Tool was developed and was used to facilitate site visits and interviews with hospital facility leaders. The Survey Tool can be found in Appendix 2.0.

A considerable amount of time was spent on hospital screening efforts in order to identify willing facilities and engineering managers that would be willing to participate in this study. Hospitals across California were cold called multiple times. This effort was ultimately futile, with many hospitals not wanting to share information and many requiring corporate approval to proceed. LinkedIn was also used to directly reach out to hospital engineers through its messaging feature. Ultimately, insider connections proved to be the only effective way to get a hold of the facility managers for the site visit component of this project.

3.0 Site Visit Summary

This section summarizes the findings from hospital site visits that were conducted. The purpose of the site visits was to collect information on current hospital gas equipment and gather feedback from facility leaders on their gas equipment, EE program participation, hospital barriers, and any other matters they were able to discuss. Site visits lasted 30 minutes to 1 hour depending on the availability of staff at the hospital.

3.1 Hospital Building Information Summary

General details on the hospital buildings including age, number of patient beds, and any major building renovations are summarized below in Table 11.

Table 11. Hospital Building Data

	Building Age	# of Beds	Major Building Renovation	Year Built
Hospital #1	55	167	n/a	1968
Hospital #2	52	400	n/a	1971
Hospital #3	120	348	1998	1903

The study found that all the hospitals have changed ownership at least once since being built.

3.2 Site Visit and Interviews

We established contact with a total of 15 hospital directors and managers from both the facilities and engineering departments. However, after months of cold calling hospitals and follow ups, only three hospital leaders eventually agreed to a site visit. Considerable efforts were made in following up with various hospitals which included calls and emails.

Most hospitals were reluctant to speak to us, and the overall response from the facilities department was that of caution. Some hospitals needed corporate approval, and some did not have the time to go through with the site visit. Facility managers requested their hospital to remain anonymous for this study in return for their participation.

We also interviewed two other subject matter experts with relevant hospital experience, one was a former facilities director at a number of hospitals and another was a facilities consultant for a hospital belonging to a university group.

3.3 Hospital Gas Appliance Summary

The raw survey data and equipment photos gathered from this milestone can be found in Appendix 3.0 titled "Hospital Site Visit and Interview Data." Findings will be summarized from each individual hospital below.

Boilers

The hospitals each had multiple boilers to meet the buildings' hot water and steam demands. No economizers were found in any of the hospital boiler rooms. Facilities managers follow the manufacturers' maintenance schedule, and some have indicated that their boiler undergoes constant repairs. When asked about boiler retrofits, one hospital had retrofitted their boilers with Low NOx burners back in 2013, in addition to AutoFlame controllers. The boiler details are summarized in Table 12.

Table 12. Boiler Summary

Hospital	Appliance Age (Years)	DEER EUL (Years)	Model	Manufacturer	Steam/Hot Water	# of boiler
1	42	20	*Redacted*	A	Steam	2
2	42	20	*Redacted*	B	Steam	2
3	68	20	n/a	B	Steam	3
3	25	20	n/a	C	Water	2

Water Heaters

All the water heaters were observed to be storage water heaters in the three hospitals. All hospitals had multiple water heaters in order to meet the buildings' demands. Similarly, to the boilers, facility leaders claimed to follow the manufacturers maintenance recommendations for this equipment. Hot water set points varied considerably across the water heaters. None of the water heater temperature set points met the ASHRAE recommended set point for hospitals at 120°F. Water heater details are summarized in Table 13. Also note that CMS also has different temperature requirements for hand washing vs patient care as well.

Table 13. Water Heater Summary

Hospital	Appliance Age	DEER EUL	Model	Manufacturer	Type	# of water heaters
1	20*	15	n/a	D	Storage	2
1	20*	15	*Redacted*	E	Storage	2
2	25-30*	15	*Redacted*	F	Storage	3
2	25-30*	15	*Redacted*	G	Storage	1
3	7	15	*Redacted*	H	Storage	2

*= indicates an estimate provided by the hospital engineer/facilities director

Commercial Food Service Gas Equipment Summary

The commercial food service areas in each of the hospitals visited operate each appliance anywhere between 12-24 hours per day, 7 days per week. Facility leaders did not have major concerns about the food service equipment and its usage. Ovens, fryers, and gas cooktops consisted of most of the cooking equipment utilized by hospitals. Electric ranges and ovens were not included in this study. Information regarding the various food service gas equipment is summarized in Tables 14-16.

Table 14. Ovens

Hospital	Appliance Age (Years)	DEER EUL (Years)	Model	Manufacturer	Type (convection/combination)	# of Ovens
1	20*	12	n/a	I	combination	3
2	n/a	12	n/a	J	convection	4
3	12	12	*Redacted*	K	combination	1
3	12	12	*Redacted*	L	convection	1
3	12	12	*Redacted*	L	convection	1

*= indicates an estimate provided by the hospital engineer/facilities director

Table 15. Fryer

Hospital	Appliance Age (Years)	DEER EUL (Years)	Model	Manufacturer	# of Fryers
1	20*	11	n/a	K	4
2	n/a	n/a	n/a	n/a	n/a
3	12	11	*Redacted*	L	1
3	12	11	*Redacted*	L	1

*= indicates an estimate provided by the hospital engineer/facilities director

Table 16. Gas Cooktop/Hot Plate/Gas Griddle

Hospital	Appliance Age (Years)	DEER EUL (Years)	Model	Manufacturer	Type (cooktop, hot plate, griddle)	# of Appliance	# of burners
1	20*	12	n/a	M	Cooktop	3	4
2	25*	12	n/a	N	Cooktop	4	4
3	12	12	*Redacted*	L	Cooktop	1	4
3	12	12	*Redacted*	L	Cooktop	1	8
3	12	n/a	*Redacted*	L	Hot Plate	1	8
3	12	12	*Redacted*	L	Griddle	1	n/a

*= indicates an estimate provided by the hospital engineer/facilities director

Dishwasher equipment was also surveyed, however minimal data was obtained from this gas equipment due to access restrictions and the positioning of the appliance. Both hospitals #1 and #2 utilized conveyor type dishwashers.

Based on the data gathered from the three hospitals, the study compared the DEER Effective Useful Life (EUL) recommended for each appliance to the actual appliance age at each facility. Most gas equipment has reached or exceeded the DEER EUL. The results are summarized below in Table 17.

Table 17. Percentage of Hospital Gas Equipment that Meet the DEER EUL

Age	Boiler	Water Heater (Storage)	Oven-Combi	Oven - convection	Fryer	Gas Griddle	Gas Cooktop
% that are less than or equal to the DEER EUL	0	20	0	0	0	0	0
% that exceed DEER EUL	100	80	100	100	100	100	100

3.4 Measure Participation

A portion of the survey was intended to gather information on the hospital's participation in prior EE measure offerings related to the equipment they used. Measures that offered gas savings include hot water pipe insulation, hot water tank insulation, low flow pre-rinse spray valve, low flow showerhead, faucet aerator, and laminar flow restrictor. Hospital facilities leaders indicated "NO" regarding any participation in all these measures. However, there is some evidence that there was some EE program participation that was not up or midstream as referenced in Table 10. One facility leader remembered being contacted by utilities like SoCal Edison, but they never pursued anything further. None of the facility leaders recall being approached by a gas IOU. Another manager stated that the hospital was never contacted by utilities for measure or EE program participation. Only one hospital manager indicated their participation in EE programs, but it was for a water savings program.

3.5 Hospital Barriers and Drivers Survey Summary

Hospital facility leaders were all asked the same survey questions. The responses were recorded using a Five-Point Likert Scaling system to maintain consistency at each site visit. The scaling system was designed based on the importance of the specific driver or the

barrier in question. Both the hospital facility leaders, as well as the SMEs participated in this survey. At the end of the survey, facility leaders elaborated on some barriers and drivers that were of importance to their respective hospitals. Responses are summarized below:

Question #1: How much of a driver is it for end-users to reduce greenhouse gas (GHG) emissions?

Hospital #1	3
Hospital #2	5
Hospital #3	5
SME #1	4
SME #2	1

Question #2 How much of a driver is performance improvements for the end-user?

Hospital #1	5
Hospital #2	4
Hospital #3	5
SME #1	4
SME #2	4

Question #3: How much of a driver is gas savings?

Hospital #1	5
Hospital #2	4
Hospital #3	5
SME #1	3
SME #2	5

Question #4 How much of a concern is your gas bill?

Hospital #1	2
Hospital #2	2
Hospital #3	2
SME #1	4
SME #2	4

Question #5 Is the Hospital interested in upgrading appliances to more EE ones?

Hospital #1	5
Hospital #2	5
Hospital #3	5
SME #1	5
SME #2	4

Question #6 How much of a barrier is HCAI (formerly OSHPD) to implementing EE?

Hospital #1	5
Hospital #2	2
Hospital #3	5
SME #1	3
SME #2	5

Question #7 How much of a barrier is the hospitals allocated engineering budget?

Hospital #1	3
Hospital #2	4
Hospital #3	4
SME #1	5
SME #2	1

Question #8 How much of a barrier is the lack of maintenance personnel training?

Hospital #1	1
Hospital #2	4
Hospital #3	3
SME #1	4
SME #2	2

Question #9 How much of a barrier is the uncertainty of technology performance by the end use?

Hospital #1	1
Hospital #2	4
Hospital #3	1
SME #1	2
SME #2	2

Question #10 How much of a market barrier is incompatibility with existing systems for adopting newer EE gas equipment?

Hospital #1	1
Hospital #2	1
Hospital #3	1
SME #1	2
SME #2	4

Question #11 How much of a barrier is the uncertainty of future codes/standards

Hospital #1	5
Hospital #2	5
Hospital #3	1
SME #1	1
SME #2	5

Question #12 How much of a barrier is the lack of awareness of new EE appliances among designers and engineers?

Hospital #1	1
Hospital #2	2
Hospital #3	1
SME #1	5
SME #2	5

The data from the survey results are summarized and tabulated along with the mean and standard deviation in Table 18.

Table 18. Survey Results Table

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Hospital #1	3	5	5	2	5	5	3	1	1	1	5	1
Hospital #2	5	4	4	2	5	2	4	4	4	1	5	2
Hospital #3	5	5	5	2	5	5	4	3	1	1	1	1
SME #1	4	4	3	4	5	3	5	4	2	2	1	5
SME #1	1	4	5	4	4	5	1	2	2	4	5	5
Mean	3.6	4.4	4.4	2.8	4.8	4.0	3.4	2.8	2.0	1.8	3.4	2.8
Std. Dev	1.7	0.5	0.9	1.1	0.4	1.4	1.5	1.3	1.2	1.3	2.2	2.0

3.6 Observations and Discussion from Survey Results

Multiple facilities directors have indicated that the HCAI process can be difficult and have faced permitting issues in the past. Facilities directors have stated that even the simplest forms of equipment changes need to be handled through HCAI, and the minimum amount of time to get emergency approval for permits in a situation where an appliance has failed takes at least 6 months. Facility leaders have indicated that it is easier to "put up" with older equipment that causes problems than to go through the HCAI process for purchasing a new appliance.

There are additional corporate guidelines for gas equipment that hospitals must follow, and funding was stated as a barrier for hospitals when it comes to buying or replacing equipment. Hospital experts have cited the California Department of Public Health (CDPH), Centers for Medicare and Medicaid Services (CMS), Joint Commission, and Air Quality Management District (AQMD) and the various regulations associated with some of these organizations as barriers for changing equipment. It was pointed out that sometimes hospitals are not eligible for SoCalGas rebates given the conflicting appliance parameters that CMS has for heating in food service. For example, **CMS has different requirements for water heating when it comes to washing dishes versus washing hands, and these are often different from rebate requirements.**

Another healthcare facilities SME indicated that dealing with HCAI is challenging when there is a significant structural issue related to appliance replacement, such as the room dimensions, lack of space, or it is a product they have not approved. Multiple facilities leaders have cited new seismic regulations are a significant barrier. **Newer bigger equipment such as storage water heaters with a larger capacity may need more**

anchoring to meet the current seismic standards, which causes the hospital to incur more expenses related to the equipment than just the equipment replacement.

Facility directors had conflicting opinions on the hospital's carbon footprint and the need to reduce it. Some have stated that it is of major concern to the organization and there is a considerable amount of push from the executive level to reduce this. Others have stated that the topic of reducing the hospital's carbon footprint is not as important given that they are more focused on fuel savings and the day-to-day hospital maintenance and repair work. However, most facility directors felt that the need to switch to EE equipment was a significant driver, which had an average survey response of 4.8.

The need to save gas was considered a significant driver to most who participated in the survey, with an average survey response of 4.4. Some indicated that this is also tied to compensation for some hospitals, however not all facility leaders were able to confirm this. For the hospitals that do this, the better a department performs, and the more money it saves, the department is rewarded with bonuses or better compensation benefits.

Cost and the hospital's engineering budget were also discussed. Facilities leaders all expressed that the departments run lean and have a high turnover rate. There was also a significant difference in the budget for EE projects given the healthcare system. Certain healthcare groups including ones belonging to university systems had larger budgets for gas equipment, whereas other facility leaders who belonged to community hospitals that serve low-income customers mostly on Medicare/Medicaid claimed that their budget was a huge concern to them. **Experts have stated that the cost for replacing equipment in hospitals are roughly 8-10 x more than what it would cost at a residential or commercial facility given the bureaucratic requirements and costly permitting process which was previously discussed as another barrier for changing equipment.** Some facilities leaders suggested that hospitals prioritize their appliance budgets on purchasing or fixing equipment directly used in healthcare services such as X-ray machines or CT scanning equipment, as opposed to investing in newer, more efficient gas equipment. The general feedback was that if the appliance is working and not interfering with hospital activities, the facilities department wouldn't bother with its overall replacement or retrofit even if the equipment is very old.

Regarding the barriers associated with the lack of awareness of new EE equipment, several facilities leaders have indicated a significant disconnect between the commercial food service area managers and the rest of the hospital engineers and facilities department. There was a disconnect between coordinating food service equipment, as the food service leaders would prefer certain vendors and equipment over ones that would actually save the hospital money on their utility bills. Hospital politics and management decisions were cited by some facility leaders as a barrier when it comes to choosing equipment, especially in the food service area.

Hospital facility leaders were also questioned about having laundry units on their premises. Every facility leader that participated in this study had stated that laundry was outsourced and most made this transition around 10-15 years ago to save energy. Some hospitals still have their units installed but are not operational. Some stated that this is the case for most California hospitals.

Recommendations

The study has provided the following recommendations based on the findings from the literature review and site visits.

1. The study recommends increased collaboration between IOUs offering rebates for hospital applicable gas-measure offerings and regulatory institutions like CMS, AQMDs and HCAI. Since regulatory barriers are a significant hindrance for hospitals looking to update their equipment, there needs to be a better understanding of HCAI and CMS requirements including seismic standards for new measure offerings. The study also recommends HCAI consider expedited permitting and approval for hospital efficient gas equipment which meets the measure offering criteria. Obtaining permits for new gas equipment is a struggle shared by many facility managers, thus and expedited process for gas appliance retrofits that are more efficient can help encourage EE equipment adoption by rewarding hospitals that do so. Collaboration between IOUs and HCAI/CMS can also alleviate some of the burden on hospital facility managers when choosing new gas equipment by assuring that the equipment meets both measure and HCAI standards for the hospital to receive rebates.
2. The study recommends outreach efforts to encourage hospitals to switch to newer, more efficient gas equipment as opposed to fixing or replacing parts in older more outdated equipment. To meet stricter standards and achieve building decarbonization, hospital corporations should have an equipment replacement plan in place starting with the oldest equipment and most energy intensive equipment. A plan would allow for proactive planning for elective equipment updates.
3. Hospital retro commissioning is encouraged to best assess the areas that could greatly benefit from equipment retrofits. Additionally, retro commissioning as a measure offering as none of the hospitals in this study have performed building retro commissioning since the building was built.
4. Improved top-down leadership starting with the executive level is needed for hospitals to decarbonize effectively. There needs to be an internal education system in place to provide hospital facility leaders and engineers with updated information on best practices for gas equipment including new and emerging gas technology. The site visits have confirmed a considerable disconnect between different hospital

departments and the general knowledge of newer efficient gas equipment. Hospitals should prioritize sending facility leaders to conferences and develop best practices for procuring new gas equipment. Hospital training led by facility and engineering managers are recommended to spread awareness of EE equipment across all departments.

5. Additional measures and increased incentives for Ultra Low NOx burners and natural gas heat pumps [13] should be developed and included in energy efficiency programs that offer incentives for hospitals. Additional incentives to encourage hospitals to switch out older equipment that is significantly outdated needs to be explored. Expanding financial incentives may help offset some of the additional costs hospitals incur through permitting and other bureaucratic challenges.

Conclusions

Hospitals buildings are complex, and there are several factors that weigh into how a hospital operates its equipment to meet the various California standards. While the small sample of hospitals we were able to visit are not an accurate representation of all California healthcare facilities, many of the facilities leaders had similar experiences and frustrations related to management and regulatory issues that negatively impact their ability to leverage EE upgrades. The hospital facility leaders all seemed interested in improving their respective hospitals gas equipment, however different regulatory barriers and costs are significant barriers in preventing hospitals from upgrading their equipment. With increased top-down support from hospital leadership and an easier regulatory process, and more priority given to EE education and best practices, hospital leaders should receive the support they need to lower their energy consumption and embrace efficient equipment to create a more sustainable and resilient healthcare environment. Finally, it is strongly recommended that EE programs collaborate with regulatory groups like HCAI to increase hospital participation.

Appendix 1. Hospital Benchmarking Data

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
San Antonio Regional Hospital	22	240,386,722	25,733,678	578,000	416
Chino Valley Medical Center	50	40,613,711	6,059,255	111,078	366
Anaheim Hospital Campus New	46	224,878,599	25,836,485	661,949	340
Montclair Hospital Medical Center	11	23,599,450	8,643,732	74,857	315
Panorama City Hospital Campus	89	128,707,703	14,105,650	416,275	309
Paradise Valley Hospital	20	64,002,916	26,929,907	221,000	290
Kaiser Permanente Woodland Hills Medical Center	97	275,057,706	11,405,100	953,120	289
CA4011 - Woodland Hills Medical Ctr	12	247,552,378	77,214,041	860,309	288
Downey Hospital Campus	16	217,603,697	68,832,141	810,192	269
Adventist-AHTV-1100 Magellan Dr	7	20,321,700	6,617,457	77,791	261
Los Angeles Hospital Campus	68	440,131,312	53,380,533	1,701,792	259
Adventist-AHWM-1720 Cesar E. Chavez Ave	44	168,936,703	41,297,059	664,233	254
Jennifer Moreno Department of Veterans Affairs Medical Center	98	240,448,415	11,965,669	969,112	248
San Dimas Community Hospital	80	19,167,250	8,272,862	78,000	246
San Jose Hospital Campus	90	87,691,597	18,312,038	366,106	240
Highland	1	96,448,131	68,118,611	405,000	238
Anderson Pavillion (AB 802 only)	12	110,704,003	62,434,154	480,436	230
Antioch Medical Center	82	148,856,696	17,917,805	663,101	224
St Jude Medical Center, Fullerton	9	144,809,727	80,470,506	647,983	223
Adventist-AHRO-726 4th St	3	44,983,903	45,648,400	204,107	220
Queen of the Valley Medical Center, Napa	7	66,175,300	46,940,409	301,542	219

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
NATIVIDAD MEDICAL CENTER - OLD COMPLEX	2	28,882,407	3,859,291	140,135	206
Orange Coast Memorial Medical Center	57	20,249,990	16,045,945	98,616	205
Mission Hospital Laguna Beach	29	47,217,203	18,622,693	231,727	204
NorthBay VacaValley Hospital	53	18,153,777	8,448,232	90,000	202
Richmond Hospital Campus	84	65,099,601	12,188,127	325,722	200
Otay Mesa MOB Campus	24	51,854,700	3,032,981	262,091	198
Main CHLA (Black, Duque, MRI, McAlister, Page, Central Plant)	10	125,781,003	96,610,918	641,010	196
Outpatient Tower (CHLA)	66	21,582,999	7,137,029	109,994	196
OC Irvine Hospital Campus	12	143,456,904	60,441,792	733,225	196
South Bay Hospital Campus	59	181,004,999	58,142,949	928,628	195
St Joseph Hospital, Eureka	40	55,263,496	27,753,539	283,964	195
Main Hospital	22	31,594,732	25,584,956	162,418	195
CA1091 - PARKVIEW MEDICAL OFFICES	1	21,110,093	7,280,149	108,702	194
SUTTER MATERNITY & SURGERY CENTER/SANTA CRUZ	17	12,495,384	8,561,758	65,456	191
Sherman Oaks Hospital	97	24,505,710	8,724,588	130,000	189
San Jose MOB Campus	6	50,788,597	6,362,953	270,269	188
Santa Rosa Memorial Hospital, Santa Rosa	36	52,451,801	38,764,482	280,000	187
Ontario Hospital Campus	63	139,203,802	44,324,520	744,560	187
Shasta Regional Medical Center	12	43,358,012	33,592,106	233,000	186
Orchard MOB Campus	38	54,377,801	4,846,066	292,436	186
Adventist-AHSV-2975 N. Sycamore Dr	12	38,372,898	29,403,954	207,294	185
CA1011 - SOUTH BAY MEDICAL CENTER	42	107,827,699	52,788,208	584,909	184
Adventist-AHHM-1 Marcela Dr	20	13,601,800	10,315,594	74,000	184
CA2201 - GARFIELD SPECIALTY CARE	33	31,319,200	6,314,970	172,992	181

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Kaiser Permanente San Diego Medical Center	86	124,779,199	38,021,053	690,285	181
Providence St. Johns Health Center	24	139,977,698	62,245,562	784,561	178
UC Irvine Health	85	243,413,207	98,728,672	1,414,146	172
San Marcos MOB Campus	2	39,952,601	13,357,091	237,911	168
NorthBay Medical Center	48	43,599,499	25,087,842	260,000	168
Centinela Hospital Medical Center	69	53,631,700	34,532,008	320,125	168
Adventist-AHLM-975 S Fairmont Ave	28	43,855,300	31,485,153	262,008	167
5555 W. Las Positas Blvd		28,435,693		170,070	167
john George Patient	1	9,879,410	16,821,996	60,000	165
Saddleback Memorial Medical Center	1	63,052,042	69,759,379	384,185	164
South San Francisco Hospital Campus	37	50,288,899	26,671,325	306,877	164
Adventist-AHRD-372 W. Cypress Ave	79	11,167,700	11,013,474	68,520	163
PIH Health Good Samaritan Hospital Campus	26	85,701,305	64,025,488	528,432	162
San Rafael Hospital Campus	64	39,877,502	26,216,079	250,029	159
San Francisco General Hospital		216,374,774		1,370,904	158
San Francisco Bay Area		12,037,652	7,780,576	76,476	157
Laguna Honda Hospital		111,139,377		717,126	155
Chinese Hospital	12	21,954,000	21,065,509	146,330	150
PIH Health Whittier Hospital	2	112,660,701	141,186,422	766,617	147
Adventist-AHHF-115 Mall Dr	36	29,565,701	31,574,911	202,000	146
Vacaville Hospital Campus		112,457,099	37,728,479	769,409	146
Petaluma Valley Hospital - Hospital	38	14,682,400	12,409,484	103,164	142
Redlands Community Hospital	92	52,050,430	28,206,706	372,000	140

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Redwood Memorial Hospital, Fortuna, CA	54	9,052,811	5,660,027	65,802	138
NATIVIDAD MEDICAL CENTER	1	63,958,048	51,992,118	466,097	137
Children's Hospital Orange County	29	100,733,726	88,821,008	737,450	137
CN2802 - FOLSOM AMBULATORY SURGERY CENTER	1	7,659,100	5,258,256	56,307	136
CA0141 - 4950 Sunset Radiation Ctr	61	20,541,400	2,288,124	152,457	135
14850 Roscoe Blvd	43	20,638,700	18,838,878	155,788	132
Long Beach Memorial / Miller Children's	28	142,257,974	148,596,219	1,075,544	132
Fremont Hospital Campus	24	50,281,400	41,649,758	383,831	131
CA0025 - Los Angeles Medical Ctr	6	106,636,205	117,710,127	814,954	131
Garden Grove Hospital Medical Center	56	18,814,650	17,161,258	144,150	131
Encino Hospital Medical Center	61	16,435,930	14,023,503	126,260	130
Providence Mission Hospital Mission Viejo	42	58,203,703	63,848,083	452,328	129
PIH Health Downey Hospital	44	28,733,700	31,058,887	223,495	129
Rancho Los Amigos Hospital- North Campus, Support Services Building (AB 802)	21	147,035,479	74,313,741	1,145,803	128
Tri City - Medical Center	25	56,708,237	53,431,782	450,000	126
Olive View Hospital (AB 802)	72	65,006,377	45,218,088	517,000	126
Pavilion D		11,123,606	9,940,723	90,510	123
SFVSA - Saint Joseph Medical Center	31	93,991,000	97,532,064	767,201	123
Adventist-AHUV-275 Hospital Dr	80	12,337,500	11,281,780	101,170	122
Huntington Beach Hospital	66	13,305,200	12,404,306	110,767	120
St. Joseph Hospital, Orange	47	121,945,523	108,670,136	1,022,625	119

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
SFVSA - Providence Tarzana Medical Center	88	37,196,300	32,611,928	313,051	119
CN5810 - SANTA ROSA MEDICAL OFFICES 5	14	11,990,400	4,263,027	101,253	118
Fontana Hospital Campus	34	182,524,304	171,067,853	1,547,423	118
Adventist-AHSH-10 Woodland Rd	85	30,885,001	24,239,916	261,911	118
Roseville Hospital Campus	94	107,805,891	75,285,995	917,122	118
CA1201 - Carson South Bay Medical Offices	1	15,949,400	17,031,364	135,999	117
Adventist-AHSE-1141 Rose Ave	98	8,848,900	7,947,506	75,681	117
Santa Clara Homestead Medical Center	75	145,182,901	99,629,844	1,251,616	116
Adventist-AHBD-2615 Chester Ave	82	30,377,900	43,050,355	261,950	116
Advanced Medicine Center (AMC)		30,543,499	24,293,438	263,380	116
CA0201 - Foothill Medical Offices	39	20,670,600	4,218,248	178,580	116
San Francisco Hospital Campus	78	41,708,099	32,606,563	366,032	114
Santa Rosa Hospital Campus	69	58,466,998	39,447,548	513,255	114
Fresno Surgical Hospital	5	8,416,306	13,413,320	75,249	112
Kaiser Permanente Zion Medical Center	67	72,225,801	67,199,446	651,043	111
Steven Spielberg Building	1	10,883,600	19,480,180	98,618	110
Oakland Medical Center	89	103,884,197	77,891,464	946,307	110
CN1118 - OAKLAND BROADWAY MEDICAL OFFICES	72	18,297,100	2,728,047	169,195	108
1500 Owens Street		18,100,923	16,584,431	167,930	108
Bellflower MOB Campus	1	36,958,002	37,545,052	349,337	106
HS - High Desert Reg Health Ctr (AB 802)		14,869,986	12,911,460	142,365	104
Moreno Valley Hospital Campus	33	23,258,100	27,403,884	223,253	104

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Kaiser Hospital	79	41,708,902	32,606,583	401,090	104
Baldwin Park Hospital Campus	46	79,267,200	86,942,854	767,226	103
San Francisco - French MOB Campus	79	29,952,100	3,580,580	290,568	103
Ontario		5,318,473	7,521,279	51,993	102
Alvarado Hospital Medical Center - West Tower	51	10,651,239	11,020,075	107,000	100
SFVSA - The R&P Disney Family Cancer Ctr	1	5,706,700	6,165,719	57,902	99
La Mirada		6,666,745	6,260,487	67,983	98
Kaiser Hospital Walnut Creek		60,050,296		627,421	96
Orange Coast Memorial - Patient Care Pavilion	6	15,893,630	13,371,621	167,055	95
Modesto - Crestwood Manor		4,878,740	2,027,409	51,356	95
Alameda Hospital	96	16,605,885	12,479,729	175,000	95
Riverside Hospital Campus	77	69,157,902	76,922,928	746,567	93
San Leandro	90	13,334,407	12,310,362	144,000	93
Kaiser Permanente Sacramento Medical Center	92	45,609,401	56,461,385	493,139	92
LCOM - Torrance Hospital	80	40,587,899	54,785,738	442,861	92
Westminster		10,274,522	12,525,655	113,341	91
CN6801 - TOMMYDON/MEMBERSHIP CALL CENTER	13	5,085,300	3,694,022	56,102	91
CA6031 - STOCKDALE MEDICAL OFFICES	19	6,625,300	6,841,128	73,092	91
Modesto Hospital Campus	97	61,246,496	50,697,683	681,500	90
Adventist Glendale	69	6,847,200	5,370,627	76,197	90
Vallejo Hospital Campus	100	80,877,303	21,175,509	905,776	89
PIH Health, Washington MOB	11	4,615,000	3,592,053	51,903	89
CA3051 - West Los Angeles Medical Ctr	48	54,846,178	67,579,025	618,517	89

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Adventist-AHHF-450 N Greenfield Ave	23	7,970,300	5,809,045	90,571	88
Harbor UCLA Medical Center Campus (AB 802)	39	84,065,194	111,846,019	957,117	88
South Sacramento Hospital Campus	87	68,314,299	62,601,307	782,909	87
West Anaheim Medical Center	86	13,846,880	19,524,684	159,000	87
CA3052 - West Los Angeles West Wing Twr	63	16,829,034	20,735,990	194,781	86
Neuroscience Health Center (HMOB)	1	8,028,900	11,113,156	93,160	86
Fresno Hospital Campus	92	35,491,898	41,305,569	412,000	86
West Los Angeles Hospital	53	71,675,212	88,315,016	838,695	85
CA0032 - 4760 Sunset MOB (new)	1	5,340,300	7,356,947	63,383	84
Park Shadelands MOB Campus	10	10,175,800	7,339,927	122,519	83
Redwood City Hospital Campus		54,337,599		665,123	82
Select Specialty Hospital - San Diego (4939)		6,509,996	9,113,770	80,585	81
Adventist-AHTR-869 N Cherry St	88	13,666,901	16,673,804	169,277	81
West Los Angeles Hospital Campus	66	73,688,696	91,029,505	916,754	80
Scripps Clinic Rancho Bernardo	41	12,867,874	12,971,057	160,801	80
Dignity Merced	7	4,861,200	9,102,604	61,313	79
CN7501 - GILROY MEDICAL OFFICES	10	5,015,800	3,628,375	63,501	79
1501 Claus Rd	100	4,695,070	4,608,083	59,517	79
Hoover Pavilion	6	6,342,100	5,717,853	80,560	79
CA3511 - KRAEMER MEDICAL OFFICE I	14	9,180,299	8,344,881	117,175	78
La Palma Intercommunity Hospital	100	7,957,190	7,460,777	102,000	78

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Gavin Herbert Eye Institute	47	5,334,900	1,911,781	68,827	78
Martin Luther King, Jr. Medical Center (Campus) (AB 802)	91	120,260,852	119,680,048	1,553,225	77
CA2881 - PALMDALE MEDICAL OFFICES	49	3,839,100	1,363,742	50,012	77
3811 Valley Centre Dr	1	8,474,800	12,291,736	112,067	76
L.A. Mental Health Center MOB Campus	13	4,960,200	5,009,235	67,731	73
Corporate Pointe at West Hills - 8401	2	11,663,169	32,139,986	160,740	73
Union City MOB Campus	29	18,967,200	10,166,005	263,199	72
LAC USC Med Ctr: Hospital,In/Outpatient,Diagnostic/Treatment,Juv Hall (AB 802)	98	280,914,396	264,316,112	3,980,553	71
Manteca Medical Center	68	12,389,800	18,475,760	177,393	70
CN5860 - MEDICAL OFFICES 4	83	4,071,700	919,244	58,337	70
St. Mary Medical Center, Apple Valley	100	31,390,199	32,229,516	450,000	70
St. Joseph GH Building	100	7,761,800	4,464,375	112,323	69
Rancho		7,131,071	8,852,558	103,508	69
Rancho Cordova MOB Campus	48	8,374,601	9,041,642	121,748	69
CA5681 - Irwindale Medical Offices	4	6,417,200	9,086,094	93,686	68
Pleasanton Tech Ctr - Hacienda Dr.	100	26,244,400	-3,933,776	384,657	68
Petaluma MOB Campus	26	6,598,700	5,161,516	97,690	68
Kerlan Jobe	10	6,006,709	9,707,426	90,607	66
Santa Rosa MOB	97	11,752,738	13,139,771	177,310	66
31449101 - Regents Medical Center	1	5,006,163	8,406,636	76,154	66
10243 Genetic Center Dr	10	3,928,613	4,689,361	59,857	66
Cottle Rd MOB Campus	1	3,236,100	5,633,068	50,096	65
Bonita MOB Campus	30	4,105,000	3,364,396	63,591	65

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
0392 San Diego County Psychiatric Hospital	100	3,797,461	2,818,096	58,900	64
LCOM - San Pedro Hospital	92	19,864,700	30,298,696	311,175	64
CA0041 - 1505 N. Edgemont Medical Of	3	5,595,500	9,267,319	91,305	61
CA6041 - MING MEDICAL OFFICES	9	3,276,800	4,622,577	53,802	61
ACC	27	3,584,826	5,886,519	58,942	61
CA2521 - Panorama City MOB 5	24	7,986,100	9,849,269	132,000	61
Scripps Clinic Valley Centre	39	8,474,800	12,265,729	142,563	59
Adventist-AHGL-1509 Wilson Terrace	99	79,756,906	80,007,336	1,350,010	59
CA5081 - MORENO VALLEY MEDICAL OFFICES	54	3,914,000	3,414,961	66,557	59
Scripps La Jolla - AMP Building	12	10,188,183	13,666,928	176,000	58
Delta Fair MOB Campus	28	4,893,600	5,238,129	85,093	58
3838 California St.	46	4,559,913	4,904,085	80,228	57
355-365 Lennon Ln	38	5,105,148	4,708,188	90,000	57
Alvarado Hospital Medical Center - East Tower	85	10,338,790	24,145,408	185,737	56
CN9301 - San Ramon Medical Offices	53	3,918,000	3,185,941	70,456	56
CA0051 - 4900 Sunset Medical Offices	31	8,494,600	8,555,480	152,810	56
CA5581 - MONTEBELLO MEDICAL OFFICES	14	3,217,900	3,343,510	57,938	56
Normandie North MOB Campus		4,412,989	6,660,946	80,458	55
CA2811 - SANTA CLARITA MEDICAL OFFICES	31	3,805,700	4,663,245	69,867	54
CA3761 - CHAPMAN MEDICAL OFFICES	12	2,937,700	3,928,740	54,366	54
CA2711 - Santa Clarita Tourney Medical Offices	56	6,266,800	6,345,497	116,800	54
PIH Health, Wells MOB	31	5,885,100	12,187,685	109,811	54

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Adventist-AHBD-1524 27th St	1	2,961,400	8,151,472	55,686	53
St. Jude Medical Center - Medical Plaza II	100	5,173,800	8,363	98,220	53
Scripps Green Hospital	68	16,530,268	40,648,118	314,663	53
Mission Hospital - MOB 3	20	2,879,900	3,604,283	55,715	52
DHS - Hubert H. Humphrey Comprehensive Health Center (AB 802)		7,243,817	8,273,842	143,209	51
Mission Hospital Cancer Center	64	14,852,100	14,245,504	302,549	49
Martinez MOB Campus	54	13,444,100	12,571,652	274,423	49
Eastmont	100	2,604,196	275,763	54,250	48
Ames Building - Palo Alto Center		14,399,520		300,000	48
CA3941 - HARBOR/MACARTHUR MEDICAL OFFICES	8	3,719,100	6,807,250	80,226	46
CA3831 - LA PALMA MEDICAL OFFICES	33	3,005,400	3,945,036	64,862	46
St. Jude Medical Center - Medical Plaza I	1	4,540,500	18,477,561	98,272	46
Blake Wilbur Clinic	25	3,572,600	7,148,221	77,500	46
Stockton MOB Campus	36	16,200,199	24,802,951	351,454	46
XIMED		9,385,551	17,943,734	204,000	46
CA3571 - GARDEN GROVE MEDICAL OFFICE	26	4,128,000	7,105,192	91,648	45
CN0601 - Dublin Medical Offices	57	10,162,300	12,014,305	227,418	45
Pleasanton MOB Campus	100	5,602,300	1,189,160	125,766	45
CA0671 - CUDAHY MEDICAL OFFICES	2	2,711,600	5,772,141	60,991	44
CA2371 - CARMEL VALLEY MEDICAL OFFICES	37	2,237,600	2,682,913	50,469	44
CN4451 - TANTAU	43	4,564,400	5,528,272	103,023	44

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
CN6501 - SLEEPY HOLLOW MEDICAL OFFICES	56	2,961,300	3,573,868	66,895	44
CA2511 - Panorama City MOB 4 - Old Hospital	14	4,568,600	9,426,315	103,365	44
CA2511 - PANORAMA CITY MOB 4	82	4,567,800	10,696,496	103,365	44
PIH Health, Hacienda Heights MOB	63	2,344,700	2,834,566	53,845	44
CA5541 - DIAMOND BAR MEDICAL OFFICES	36	2,956,400	3,305,228	67,987	43
CA5341 - Murrieta Medical Offices	58	3,647,400	4,582,312	83,999	43
Adventist-AHLM-800 S Lower Sacramento Rd	75	2,206,900	2,160,246	52,398	42
Daniel Burnham Court - Commercial		4,517,651	2,192,381	107,503	42
18425 Burbank Boulevard	9	3,859,800	7,515,062	92,356	42
PIH Health, Whittwood MOB	64	2,613,200	3,248,683	63,016	41
Scripps Mercy SD 550	25	2,825,723	4,489,514	68,652	41
Lompoc - Crestwood Champion Health Center		2,992,550	2,554,092	73,090	41
CA3851 - YORBA LINDA MEDICAL OFFICES	70	2,011,600	794,170	50,816	40
Mountain View MOB Campus	50	2,232,200	3,122,700	56,803	39
Napa MOB Campus	78	2,656,400	1,565,545	67,711	39
Bishop Ranch 11 C	88	2,200,884	2,305,928	56,802	39
9730 Summers Ridge Rd	1	3,935,200	20,091,720	101,940	39
CN3760 Redwood City Veterans MOB	78	2,404,800	2,123,407	62,500	38
CA0451 - Hollywood Romaine Med Offices	62	2,135,600	2,419,299	55,608	38
CA2581 - North 2 Medical Offices	77	5,571,800	6,932,835	146,413	38

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
CA6581 - Chino Grand Medical Offices	77	1,988,200	1,665,496	53,147	37
Fallbrook - Crestwood Fallbrook Healing Center		2,828,780	3,038,349	75,684	37
CN6115 - POINT WEST MEDICAL OFFICES	77	8,536,801	12,164,280	228,737	37
30 River Park Place W	97	2,655,735	3,277,242	71,442	37
1400 Florida Ave	76	1,976,970	2,252,132	53,740	37
CN6014 - WYNDHAM MEDICAL OFFICES	66	2,555,200	3,380,739	69,722	37
CA3381 - Baldwin Hills Crenshaw Medical	47	4,089,600	6,486,798	112,579	36
CN7201 - FRESNO MEDICAL OFFICES I - FIRST ST.	54	2,365,700	4,052,484	65,224	36
PAMF Dublin Center		2,077,000	4,534,953	57,786	36
CN3450 - DALY CITY MEDICAL OFFICES	95	10,496,101	6,302,690	293,818	36
Z122 - UCDMG Midtown Clinic	76	3,837,798	5,006,881	107,593	36
East Los Angeles MOB Campus	41	2,383,200	3,481,420	67,165	35
CA0271 - 4700 Sunset Medical Offices	28	4,035,600	8,295,949	113,922	35
Brea		2,808,324	6,957,173	80,000	35
1524 McHenry	86	4,436,516	10,377,394	126,617	35
Corona MOB Campus	50	4,161,700	7,176,531	118,797	35
MOUNTAIN VIEW CENTER	75	8,977,066	19,360,486	260,006	35
CA5331 - Meridian Medical Offices	72	1,923,600	2,551,852	56,136	34
300 Fir St	61	2,246,574	3,921,388	66,009	34
PIH Health, Downey Campus MOB	51	2,446,700	4,044,195	72,193	34
CN2450 - LIVERMORE MEDICAL OFFICES	100	2,406,500	266,378	71,021	34
CN4001 - FAIRFIELD MEDICAL OFFICES	100	1,808,500	-321,380	53,673	34

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Scripps Business Services 4S Ranch	92	5,408,533	5,257,607	160,801	34
Mercy San Juan Medical Center	100	3,324,424	6,179,226	99,408	33
UCI Family Health Center Santa Ana	27	1,679,734	3,109,125	50,444	33
CN6152 - FAIR OAKS MEDICAL OFFICES	87	2,338,800	3,185,173	70,708	33
Lancaster MOB Campus	55	4,174,700	10,094,707	126,380	33
31421101 - Providence Mission Hills	99	2,376,100	1,426,240	72,821	33
CA0821 - Cerritos Medical Offices	85	3,545,700	4,396,440	108,800	33
0385 Health Services Complex		4,482,239	10,343,464	138,182	32
1414 South Grand Avenue	62	2,006,000	2,984,271	61,949	32
Adventist-AHHF-125 Mall Dr	43	1,776,800	5,147,449	54,911	32
CN2601 - LINCOLN MEDICAL OFFICES	72	2,496,400	3,587,254	77,423	32
CN0950 - PINOLE MEDICAL OFFICES	71	1,978,300	2,369,637	61,693	32
Lakeview MOB Campus	84	2,673,600	5,608,392	83,723	32
CN6950 - ELK GROVE PROMENADE MEDICAL OFFICES	78	2,029,800	2,696,490	64,236	32
CA1791 - RANCHO CUCAMONGA MEDICAL OFFICES	21	1,617,900	3,898,857	51,675	31
CA2211 - VANDEVER MEDICAL OFFICES	81	4,325,100	7,335,086	138,585	31
2505 Samaritan Drive		1,592,506	987,864	51,087	31
CN1114 - MOSSWOOD MEDICAL OFFICES	93	6,055,200	6,644,375	195,579	31
Z042 - Glassrock	38	2,179,419	4,122,864	71,014	31
Panorama North Medical Offices	79	8,601,500	12,853,156	280,949	31

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
DHS - H. Claude Hudson Comprehensive Health Center (AB 802)		2,497,200	5,931,347	82,740	30
16899 W Bernardo Dr	69	3,044,755	5,016,718	101,551	30
Tarzana Medical Office Building	58	1,954,830	5,930,890	65,699	30
Medical Arts Plaza # 1	92	2,724,287	2,200,760	91,652	30
Medical Arts - 1162 Montgomery Drive	98	2,763,350	2,225,352	93,048	30
San Dimas MOB Campus	74	1,686,800	2,447,574	57,353	29
CN7901 - San Jose Skyport Medical Office	100	4,516,500	2,841,322	154,740	29
PAMF - Sunnyvale Center - 301	66	3,672,460	9,610,617	125,830	29
CA2601 - Antelope Valley Medical Offices	100	4,980,700	-101,971	171,353	29
1 Daniel Burnham Court	70	3,652,315	6,010,833	127,503	29
CA3171 - Venice Medical Offices	80	2,014,600	2,714,536	72,539	28
CA0181 - 1515 N. VERMONT MEDICAL OFFICES	50	3,842,900	11,269,118	138,419	28
CA3521 - EUCLID MEDICAL OFFICES	39	1,803,300	2,892,335	65,060	28
Breeze MOB	63	2,802,300	5,646,450	102,263	27
2581 Samaritan	89	3,119,300	7,055,480	115,528	27
3140 KEARNEY ST		1,931,713	3,509,623	73,600	26
Adventist-AHHF-1025 N. Douty St	92	2,696,300	4,307,325	103,661	26
CN2850 - FOLSOM MEDICAL OFFICES	80	3,135,000	6,093,985	121,378	26
31422101 - Sherman Oaks Medical Plaza	59	1,885,200	4,338,784	74,095	25
450 Sutter	100	6,792,159	9,379,434	268,131	25
Manchester Pavilion	60	4,533,793	12,801,298	179,028	25
CA3081 - INGLEWOOD MEDICAL OFFICES	83	1,977,800	3,953,631	78,174	25

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
31445101 - 435 N. Bedford	100	1,418,600	386,112	56,527	25
DHS - El Monte Comprehensive Health Center (AB 802)		2,346,652	4,553,230	93,551	25
CA2571 - Panorama City Medical Offices 3	176	6,060,400	10,391,228	244,248	25
90 E Tasman Ave	99	2,382,426	1,303,054	96,154	25
1901 W Lugonia Ave	70	1,236,700	5,093,873	50,077	25
Garden Grove MOB	55	1,413,010	3,062,767	57,487	25
Saint John's Medical Plaza		2,350,600		95,667	25
2929 Health Center Dr	1	1,466,681	9,797,753	59,857	25
Fountain Valley V	68	1,770,888	6,327,086	72,731	24
Alhambra Medical Office Building	90	2,461,491	5,436,938	101,133	24
CN3050 - ELK GROVE MEDICAL OFFICES	64	2,523,800	6,142,135	105,036	24
New Stanford Hospital (NSH)	4	20,140,700	94,007,416	849,370	24
Civic Center Place	81	2,584,579	5,039,795	110,679	23
PAMF - FREMONT CENTER - MOB		2,911,297	3,879,218	125,000	23
CA8891 - Ventura 4949 Market St. Medical	62	1,490,500	3,074,215	64,606	23
CA5521 - BALDWIN PARK MEDICAL OFFICE	100	1,736,000	1,364,725	75,740	23
Fountain Valley III	96	1,466,245	3,061,750	64,004	23
CA1131 - LONG BEACH PLAZA MEDICAL OFFICES	98	3,313,300	3,647,120	145,056	23
Bostonia MOB Campus	73	2,279,000	5,598,893	100,510	23
John Muir Health MOB		2,336,227	6,372,175	103,903	22
39080101-EL CAMINO LOS GATOS	48	1,243,600	3,107,697	55,927	22
CN4301 - TRACY MEDICAL OFFICES	66	1,130,300	2,574,398	51,092	22

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
31466329-Wilbur Medical Plaza Tarzana	43	1,182,600	3,453,708	53,606	22
CN2950 - CLOVIS MEDICAL OFFICES	72	1,485,100	3,777,763	67,346	22
San Diego - MHRC & Hummingbird Healing House		1,419,420	2,122,343	65,699	22
31446101 - 436 N. Bedford	55	1,637,100	3,591,866	76,273	21
CN9710 - Sacramento Downtown MOB	100	8,368,800	8,293,009	397,767	21
Broadway Webster	58	2,019,329	5,409,901	99,942	20
CN0501 - Roseville Riverside Cirby Med Off	94	3,848,700	7,344,810	193,088	20
DHS - Edward Roybal Comprehensive Health Center (AB 802)		4,531,887	10,324,864	227,617	20
CN9401 - San Francisco Mission Bay MOB	87	4,411,700	8,479,065	221,660	20
PIH Health, Brookshire MOB	94	1,161,395	2,824,727	58,979	20
31466187-METHODIST SO CAL SANTA ANITA	81	1,678,100	4,245,759	86,762	19
Beverly Pico	94	1,806,800	3,517,908	97,697	18
CA1561 - REDLANDS MEDICAL OFFICES	75	2,225,100	6,198,194	120,835	18
Mid Valley Comprehensive Health Center (AB 802)		1,827,591	4,761,440	100,000	18
La Mesa MOB Campus	99	3,185,000	3,296,432	175,348	18
CA3611 - TUSTIN SANTA ANA MEDICAL OFFICES	73	1,309,000	4,258,848	72,241	18
LPCH Main	58	14,089,100	65,564,989	785,892	18
8540 S Sepulveda Blvd, Los Angeles, CA 90045	100	1,408,200	214,304	78,900	18
Scripps Geisel Pavilion	100	2,775,379	254	156,920	18
1563 Mission Street	99	877,975	1,146,875	51,052	17
Geary Medical Office Building	98	7,047,355	12,069,470	420,000	17

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Cotton Medical North Tower	80	881,836	2,217,580	52,731	17
CN3112 - 2238 GEARY MEDICAL OFFICES	99	7,046,700	12,069,454	423,160	17
2801 Shadelands Drive	100	4,920,231	2,504,803	295,561	17
151910 -HTA-Northridge I, LLC	78	1,106,700	3,739,886	67,965	16
Desert Valley Hospital	100	1,966,929	12,285,853	122,140	16
CN3301 - SAN MATEO MEDICAL OFFICES	94	1,067,600	2,146,949	68,499	16
DHS - Long Beach Comprehensive Health Center (AB 802)		1,254,103	2,467,820	82,155	15
CA3791 - Tustin Ranch Medical Offices	100	2,215,700	3,768,799	148,162	15
Newport Lido Medical Center	86	2,412,399	15,419,772	162,170	15
Taj Mahal Medical Center	91	1,286,463	3,968,352	86,986	15
Martin Luther King, Jr. Behavioral Health Center (AB 802)	100	8,180,753	39,217,170	560,493	15
Riverside Medical	88	750,308	2,152,318	52,767	14
Oakland Hospital (Old)	100	10,113,400	11,708,529	718,571	14
Pacific Professional Building	97	2,007,557	6,791,718	142,662	14
Cotton Medical South Tower	69	850,818	3,200,511	62,903	14
Mercy Medical Building	95	1,145,391	3,950,582	91,137	13
1870 Lundy Ave	100	698,617	65,409	56,000	12
31231101 - Southern California Orthopedic Institute	23	1,089,700	6,524,463	88,500	12
31489101-UCIH Costa Mesa	39	875,200	5,435,865	76,880	11
High Desert - Victorville Campus	41	656,500	4,905,381	58,532	11
3800 Chapman Pavilion	97	1,768,090	5,938,790	158,590	11
Saddleback Medical Office Building	99	1,428,692	4,800,383	135,904	11

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
Cedars Sinai I (East) - 8631 W 3rd St	99	1,773,130	7,422,147	172,688	10
Cedars Sinai II (West) - 8635 W 3rd St	97	1,773,130	9,007,960	172,789	10
Adventist-AHBD-2620 Chester Ave	2	483,500	6,644,470	54,040	9
South Park Group - 5901 Olympic Blvd.	98	843,100	3,047,687	97,035	9
Adventist-AHWM-1828 E. Cesar Chavez Ave	31	413,800	3,045,459	50,220	8
Mental Health Services -- 1380 Howard		672,130		84,000	8
31450101 - Regents Court	100	449,904	1,514,936	56,422	8
6325-6355 Topanga Canyon Blvd		1,966,600	8,963,459	266,924	7
North Coast Health Center		910,035	8,314,664	130,088	7
Adventist-AHWM-1700 E. Cesar E. Chavez Ave	18	492,600	6,709,752	71,227	7
VA Outpatient Clinic		906,875	2,099,209	135,000	7
CA2591 - Panorama City Medical Offices 6	83	434,800	2,313,472	68,490	6
250-254 E Hacienda Ave	85	458,001	3,251,226	73,754	6
1245 Wilshire Blvd. Medical Office Building		1,783,500	16,427,004	313,089	6
California Rehabilitation Institute (5661)		713,913	9,214,019	174,098	4
O'Connor Health Center 1	74	211,163	2,592,335	52,000	4
10 Kirk Veterans		223,279	46,333	55,000	4
SJHH SJoHMG Chapman	88	235,100	2,750,365	58,000	4
3261 Overland Ave	100	314,500	658,762	80,441	4
939 Ellis		261,142	1,336,707	87,190	3
West Hills Medical Center	74	160,164	3,662,718	63,012	3
Fountain Valley IV	94	158,421	2,555,474	66,088	2

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
31447102 - Tustin MOB II	65	120,900	2,587,145	54,671	2
Mark Goodson Building	94	231,179	6,546,088	113,387	2
Brentwood Medical Plaza	98	187,400	3,778,541	98,234	2
Adventist-AHBD-2700 Chester Ave	76	103,700	3,478,544	59,692	2
Northern Valley Indian Health	100	122,540	621,575	84,000	1
Wilshire Tower	100	221,450	7,879,478	201,894	1
Robertson Center		75,463	2,339,340	76,711	1
CMK2 Oak Valley, LLC	94	46,200	1,602,974	51,000	1
Scripps La Jolla - Hospital Campus	100	1,439,323	96,791,370	1,876,445	1
RB Medical Plaza	99	52,094	2,180,891	71,735	1
1441 Florida Ave	77	305,070	61,877,704	477,697	1
Adventist-AHWM-1701 E Cesar E Chavez Ave	92	55,800	4,680,110	93,342	1
39051101-DIGNITY GLENDALE	87	24,300	2,768,357	57,600	0
Advanced Health Sciences Pavilion (AHSP)		298,600	55,602,436	818,090	0
31466177-TENET LOS ALAMITOS	76	18,700	4,024,481	57,007	0
31242101 - Loma Linda Univ Med Ctr Murrieta Prof Office Bldg	96	41,900	7,128,346	152,797	0
7111 Winnetka Ave - Medisco Medical Center	100	3,700	644,186	67,489	0
Brentwood MOB	100	861	311,923	51,599	0
1040 Elm Ave				80,150	-
1043 Elm Ave				69,188	-
10672 Wexford St	92		2,285,621	60,985	-
1111 E. Stanley Blvd				79,000	-
1195 W Fremont Ave				79,890	-
12665 Garden Grove Blvd	71		4,462,806	77,504	-

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
14901 Rinaldi St	55		3,521,995	52,926	-
151912 - Bakersfield Medical Office Building				83,760	-
31419101 - Henry Mayo Center				75,722	-
31494101- Providence Medical I				86,073	-
31499101- PSJH Mission Viejo	2		14,232,437	104,546	-
514 N Prospect Ave	95		8,214,082	137,124	-
5725 W. Las Positas Blvd				58,130	-
9201 W Sunset Blvd	80		9,339,886	178,208	-
931 Buena Vista St	89		2,975,196	67,520	-
Adventist-AHCL-15630 18th Avenue	69		8,199,192	53,281	-
Adventist-AHGL-1560 E. Chevy Chase Dr	27		4,082,826	53,907	-
Adventist-AHSR-1000 Greenley Rd	64		19,158,736	175,967	-
Adventist-AHSR-900 Mono Way			5,027,176	74,100	-
Alvarado Road 6719 LLC	94	-	2,015,269	52,366	-
Banner Lassen Medical Center	100		350,255	121,976	-
Bayview Behavioral Health Hospital			3,895,087	60,456	-
CA2491 - RANCHO BERNARDO MEDICAL OFFICES	61		2,702,403	52,911	-
Caddis - Shadelands				60,000	-
CN5955 - Roseville 1660 Parkway Plaz	98		2,701,850	73,180	-
CN7001 - Santa Rosa Medical Offices 6	100		172,023	88,719	-
CN7751 - Scotts Valley Medical Offices	100		1,032,365	52,227	-
CPMC MBH - MONTEAGLE MEDICAL CENTER	100	-	-	116,285	-

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
CPMC PACIFIC CAMPUS - ANNEX BUILDING	100		1,084,220	71,616	-
Facey Immediate Care Mission Hills			5,389,595	124,059	-
Genesee Plaza			8,067,598	161,185	-
Harbor UCLA Professional Building (MFI) (AB 802)	98		1,933,071	54,087	-
LPCH West	57	-	32,184,556	307,290	-
Martin Luther King, Jr. Medical Office Building (AB 802)				52,000	-
PALMDALE MEDICAL PROPERTIES, LLC				59,577	-
Patient Tower			15,814,455	323,056	-
Pavilion			6,819,489	80,015	-
Pavilion A			11,575,550	88,120	-
Pavilion B				95,770	-
PH - Central Public Health Center (AB 802)			20,215,570	60,924	-
Saddleback Medical Tower (All Electric)	99		5,831,113	141,985	-
Saddleback Professional Center				73,078	-
San Diego 17140 Medical Properties				83,213	-
San Leandro Hospital Campus			-359,427	677,418	-
Scripps Clinic Del Mar	84		2,755,967	59,500	-
Scripps La Jolla - Main Hospital	1		103,250,315	432,500	-
Scripps La Jolla - Poole Building	97		3,357,763	81,954	-
Scripps La Jolla - Prebys Building	100		6,834,232	382,162	-
Scripps Mercy Hospital Campus	100		17,983,031	609,326	-
Scripps Mercy SD - Hospital	100		3,848,460	521,805	-

Healthcare Facility Name	ENERGY STAR Score	Natural Gas Use (kBtu)	Electricity Use - Grid Purchase (kBtu)	Property GFA - Calculated (Buildings) (ft²)	Natural gas Use per Square Feet (kBtu/ft²)
St. Joseph Hospital Orange - Cancer Center				87,000	-
Stanford Hospital	48	-	95,211,761	1,125,960	-
The Laguna				57,573	-
USACA294				60,206	-
USACA295				55,218	-
USACA373				62,969	-
Vatche and Tamar Manoukian Medical Building	92		8,812,597	127,766	-
Grand Total	23335	10,925,314,804	7,841,057,280	109,037,311	-

Appendices

Appendix 2.0 CEDARS Data Collection

The following steps were taken to gather program and efficiency data for hospitals from 2020-2022:

1. Yearly Statewide Claims Data was downloaded from CEDARS at: Record-level Report - CEDARS (sound-data.com)
2. A power pivot table was created to sort the data
3. For each year, the following filters were applied
    a. Filtered out Building types to only include “healthcare”
4. Used the “Measure ID” category to generate a list of measures within the filter along with the Program Frequency, Number of Units Installed, and their corresponding First Year Net Therms savings.
5. From this list, programs that were electric were filtered out in addition to any programs that did not have gas savings
6. The charts and tables in Section 1.0 Literature Review, reflect this data collection effort

Appendix 3.0 Survey Tool

General Hospital System Questions

- ❑ Has it been RCxd?

Overall Building Controls

- ❑ HVAC air distribution type?
- ❑ Air and/or water distribution systems (Use of outdoor air and air distribution is big in hospitals, as much as 100% of it is outdoor)
- ❑ DOA (dedicated outdoor air system) unit
- ❑ Vent Hoods
- ❑ Process Loads for Sterilizers

Commercial Food Service Measures and Appliances to Survey

Capture general pictures of the kitchen

- ❑ Combination Oven
    - Nameplate Picture (Y/N):
    - Usage (HPD and Days/week):
    - Appliance Age:
    - Regular Maintenance:
    - Retrofits:
    - Problems:
- ❑ Convection Oven
    - Nameplate Picture (Y/N):
    - Usage (HPD and Days/week):
    - Appliance Age:
    - Regular Maintenance:
    - Retrofits:
    - Problems:
- ❑ Fryer
    - Nameplate Picture (Y/N):
    - Usage (HPD and Days/week):
    - Appliance Age:
    - Regular Maintenance:
    - Retrofits:
    - Problems:

- ❑ Undercounter Dishwasher
    - Nameplate Picture (Y/N):
    - Usage (HPD and Days/week):
    - Appliance Age:
    - Regular Maintenance:
    - Retrofits:
    - Problems:
- ❑ Door Type Dishwasher or Flight or Conveyor Type
    - Nameplate Picture (Y/N):
    - Usage (HPD and Days/week):
    - Appliance Age:
    - Regular Maintenance:
    - Retrofits:
    - Problems:
- ❑ Gas Grill
    - Nameplate Picture (Y/N):
    - Usage (HPD and Days/week):
    - Appliance Age:
    - Regular Maintenance:
    - Retrofits:
    - Problems:
- ❑ Other

Space Heating Measures and Appliances to Survey

Capture general pictures of the boiler room

- ❑ Boiler
    - Application (heating, hot water, process or a combination)
    - Reset/sequencing controls
    - Building level boiler controls
    - Appliance Age:
    - Nameplate Picture (Y/N):
    - Model name and Manufacturer
    - Steam/Hot water?
    - Condensing or Noncondensing?

- Regular Maintenance:
- Retrofits:
- Problems:
- # of Boilers:
- Economizer present?
- Add-on controls?
- Linkageless controls?

❑ Furnace

- Building level furnace controls
- Reset/sequencing controls
- Appliance Age:
- Nameplate Picture (Y/N):
- Model name and Manufacturer
- Condensing or Noncondensing?
- Regular Maintenance:
- Retrofits:
- Problems:

❑ Other (Steam Traps)

Measure recommendations based on boiler study:

- Exhaust Vent Condenser present?
- Energy recovery using a flash vessel?
- Flash Recovery Equipment?
- Dual returns and smart plate heat exchanger?
- Boiler reset controls (HVAC)

Water Heating Measures and Appliances to Survey

Capture general pictures of the boiler room (if separate from the ones above)

❑ **Water Heaters**

- Nameplate Picture (Y/N):

- Water heater model name
- Type of water heater (Storage/Tankless/Condensing/Noncondensing)
- # of Water Heaters

- Regular Maintenance:
- Appliance Age:
- Note the Hot water set point temperature (120 F for ASHRAE hospital guidelines):
- Hot water pump recirculation control type:

Other Categories

- ❑ Hot Water Pipe Insulation
  - Measure participation?
- ❑ Hot Water Tank Insulation
  - Measure participation?
- ❑ Low Flow Pre-Rinse Spray Valve
  - Measure participation?
- ❑ Low Flow Showerhead
  - Measure participation?
- ❑ Faucet Aerator
  - Measure participation?
- ❑ Laminar Flow Restrictor
  - Measure participation
- ❑ Other

Other Questions:

1. Is Laundry in house vs. Outsourced? Get detailed information on washing and drying if in house.
2. Check if all appliances are certified as ENERGY STAR compliant:
3. Ask hospital engineers/facility managers about any equipment/comfort problems they are having?
4. Have they participated in any EE programs, if so which and when? Other questions relating to EE programs
   a. How much of a driver is it for end-users to reduce GHG emissions? (1-5)

1	2	3	4	5

b. How much of a driver is performance improvements for the end-user? (1-5)

1	2	3	4	5

c. How much of a driver is gas savings? (1-5)

1	2	3	4	5

5. How much of a concern is your gas bill (1-5)?

1	2	3	4	5

6. Is the hospital interested in upgrading appliances to more EE ones?

1	2	3	4	5

7. Barriers preventing EE equipment adoption

a. How much of a barrier is HCAI (formerly oshpd) to implementing EE (1-5)

1	2	3	4	5

b. How much of a barrier the hospitals allocated engineering Budget (1-5)

1	2	3	4	5

c. How much of a barrier is the lack of maintenance personnel training (1-5)

1	2	3	4	5

d. How much of a barrier is the uncertainty of technology performance by the end user? (1-5)

1	2	3	4	5

e. How much of a market barrier is incompatibility with existing systems for adopting newer EE gas appliances? (1-5)

1	2	3	4	5

f. How much of a barrier is the uncertainty of future codes/standards (1-5)

1	2	3	4	5

g. How much of a barrier is the lack of awareness of new EE appliances among designers and engineers (1-5)

1	2	3	4	5

Appendix 4.0 Hospital Site Visit and Interview Data

Site #1
Building built/ major: 1968, 167 bed Renovations dates: N/A

Note: Obtain photos and images of appliances if able to, specifically Appliance Energy Guide ratings and equipment plates. Confirm fuel is natural gas.

General Hospital System Questions

- Has it been RCxd? : No

Overall Building Controls

- HVAC air distribution type?- SIEMENS control system to adjust temperature and humidity
- Air and/or water distribution systems (Use of outdoor air and air distribution is big in hospitals, as much as 100% of it is outdoor) N/A
- DOA (dedicated outdoor air system) unit: N/A
- Vent Hoods: N/A
- Process Loads for Sterilizers: They have sterilizers but not sure about loads

Commercial Food Service Measures and Appliances to Survey Capture general pictures of the kitchen


HOBART
HRO220
HOBART
W220


NATURAL GAS


DRAIN
DRAIN
BOILER FEED
BOILER FEED
MOMAR
14211

- Combination Oven
  - Nameplate Picture (Y/N): Partial, Manufacturer I Oven
  - Usage (HPD and Days/week): 7
  - Appliance Age: 20
  - Regular Maintenance: according to manufacturer recommendation
  - Retrofits: N/A
  - Problems: no
- Convection Oven
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): N/A
  - Appliance Age:20
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Fryer
  - Nameplate Picture (Y/N): Manufacturer K Fryer
  - Usage (HPD and Days/week): 7 days a week
  - Appliance Age: 20
  - Regular Maintenance: Yes
  - Retrofits: N/A
  - Problems: N/A
- Undercounter Dishwasher
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): N/A
  - Appliance Age: N/A
  - Regular Maintenance:
  - Retrofits: N/A
  - Problems: N/A
- Door Type Dishwasher or Flight or Conveyor Type
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): 7 days a week
  - Appliance Age: 5
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Gas Grill
  - Nameplate Picture (Y/N): Manufacturer M Gas Single Sided Grill

  - Usage (HPD and Days/week): 7 days a week
  - Appliance Age: 20
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Other

Space Heating Measures and Appliances to Survey Capture general pictures of the boiler room

- Boiler
  - Application (heating, hot water, process or a combination): Manufacturer A Boiler
  - Reset/sequencing controls: N/A
  - Building level boiler controls: N/A
  - Appliance Age: 1981 (42 years)
  - Nameplate Picture (Y/N): N/A
  - Model name and Manufacturer: *Redacted*
  - Steam/Hot water? Steam
  - Condensing or Noncondensing? N/A
  - Regular Maintenance: once a year inspection
  - Retrofits: no
  - Problems: Yes, issues with flame failure from burner. deal with it and replace parts as needed
  - # of Boilers: 2
  - Economizer present?: NO
  - Add-on controls? : NO
  - Linkageless controls?: NO
- Furnace
  - Building level furnace controls N/A
  - Reset/sequencing controls N/A
  - Appliance Age: N/A
  - Nameplate Picture (Y/N): N/A
  - Model name and Manufacturer N/A
  - Condensing or Noncondensing? N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Other (Steam Traps): N/A

Measure recommendations based on boiler study:

- Exhaust Vent Condenser present? N/A
- Energy recovery using a flash vessel? N/A
- Flash Recovery Equipment? N/A
- Dual returns and smart plate heat exchanger? N/A
- Boiler reset controls (HVAC) N/A

Water Heating Measures and Appliances to Survey Capture general pictures of the boiler room (if separate from the ones above)

- Water Heaters
  - Nameplate Picture (Y/N): illegible
- Water heater model name: Manufacturer D Water Heater Boiler and Manufacturer E
- Type of water heater (Storage/Tankless/Condensing/Noncondensing): Storage
- # of Water Heaters: 4 , 1 not in operation, so total 5
- Regular Maintenance: According to manufacturer
- Appliance Age: 20
- Note the Hot water set point temperature (120 F for ASHRAE hospital guidelines): 140 (multiple set point temperatures)
- Hot water pump recirculation control type: N/A

Other Categories

- Hot Water Pipe Insulation
  - Measure participation? -NO
- Hot Water Tank Insulation
  - Measure participation? -NO
- Low Flow Pre-Rinse Spray Valve
  - Measure participation? -NO
- Low Flow Showerhead
  - Measure participation? -NO
- Faucet Aerator
  - Measure participation? -NO
- Laminar Flow Restrictor
  - Measure participation: Contacted,never pursued
  - Have been asked by edison to puruse, never did.
- Other

Other Questions:

1. Is Laundry in house vs. Outsourced? Get detailed information on washing and drying if in house: Outsourced
2. Check if all appliances are certified as ENERGY STAR compliant: No
3. Ask hospital engineers/facility managers about any equipment/comfort problems they are having? no
4. Have they participated in any EE programs, if so which and when? Other questions relating to EE programs
    a. How much of a driver is it for end-users to reduce GHG emissions? (1-5)

1	2	**3**	4	5

    b. How much of a driver is performance improvements for the end-user? (1-5)

1	2	3	4	**5**

    c. How much of a driver is gas savings? (1-5)

1	2	3	4	**5**

    d. How much of a concern is your gas bill (1-5)?

1	**2**	3	4	5

    e. Is the hospital interested in upgrading appliances to more EE ones?

1	2	3	4	**5**

5. Barriers preventing EE equipment adoption
    a. How much of a barrier is HCAI (formerly oshpd) to implementing EE (1-5)

1	2	3	4	**5**

    b. How much of a barrier the hospitals allocated engineering Budget (1-5)

1	2	**3**	4	5

    c. How much of a barrier is the lack of maintenance personnel training (1-5)

1	2	3	4	5

    d. How much of a barrier is the uncertainty of technology performance by the end user? (1-5)

1	2	3	4	5

e. How much of a market barrier is incompatibility with existing systems for adopting newer EE gas appliances? (1-5)

1	2	3	4	5

f. How much of a barrier is the uncertainty of future codes/standards (1-5)

1	2	3	4	5

g. How much of a barrier is the lack of awareness of new EE appliances among designers and engineers (1-5)

1	2	3	4	5

The Facilities director indicated HCAI process is difficult, time consuming, leads to permitting issues. Lots of corporate guidelines for appliances. Money is an issue.

Site #2
Building built/ major: Built 1971, 400bed hospital renovations dates: N/A

Note: Obtain photos and images of appliances if able to, specifically Appliance Energy Guide ratings and equipment plates. Confirm fuel is natural gas.

General Hospital System Questions

- Has it been RCxd?: NO

Overall Building Controls

- HVAC air distribution type? Siemens building automated system
- Air and/or water distribution systems (Use of outdoor air and air distribution is big in hospitals, as much as 100% of it is outdoor) N/A
- DOA (dedicated outdoor air system) unit N/A
- Vent Hoods N/A
- Process Loads for Sterilizers N/A

Commercial Food Service Measures and Appliances to Survey
Capture general pictures of the kitchen


BOILER 1
ON LINE
BOILER

- Combination Oven
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): N/A
  - Appliance Age: N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Convection Oven
  - Nameplate Picture (Y/N): Manufacturer J Convection Oven (4 ovens)
  - Usage (HPD and Days/week): 7
  - Appliance Age: 20 (estimate)
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Fryer
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): N/A
  - Appliance Age: N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Undercounter Dishwasher
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): N/A
  - Appliance Age: N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Door Type Dishwasher or Flight or Conveyor Type: Conveyor Type
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week):7
  - Appliance Age: 12
  - Regular Maintenance: Yes
  - Retrofits: N/A
  - Problems: N/A

- Gas Grill
  - Nameplate Picture (Y/N): Manufacturer N
  - Usage (HPD and Days/week): 7 days a week
  - Appliance Age: 25
  - Regular Maintenance: Yes
  - Retrofits: N/A
  - Problems: N/A
- Other
  - **Space Heating Measures and Appliances to Survey**
  - **Capture general pictures of the boiler room**
- Boiler
  - Application (heating, hot water, process or a combination) Heating
  - Reset/sequencing controls N/A
  - Building level boiler controls N/A
  - Appliance Age: 1981 so 42 years
  - Nameplate Picture (Y/N):
  - Model name and Manufacturer : Manufacturer B
  - Steam/Hot water? Steam
  - Condensing or Noncondensing? N/A
  - Regular Maintenance: once a year
  - Retrofits: Deaerator Tank
  - Problems: N/A
  - # of Boilers:2
  - Economizer present? N/A
  - Add-on controls? - Deaerator Tank
  - Linkageless controls? N/A
  - Constant need of repairs for boiler
- Furnace
  - Building level furnace controls N/A
  - Reset/sequencing controls N/A
  - Appliance Age: N/A
  - Nameplate Picture (Y/N): N/A
  - Model name and Manufacturer N/A
  - Condensing or Noncondensing? N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Other (Steam Traps) N/A

Measure recommendations based on boiler study:

- Exhaust Vent Condenser present? N/A
- Energy recovery using a flash vessel? N/A
- Flash Recovery Equipment? N/A
- Dual returns and smart plate heat exchanger? N/A
- Boiler reset controls (HVAC) N/A

Water Heating Measures and Appliances to Survey
Capture general pictures of the boiler room (if separate from the ones above)

- **Water Heaters**
  - Nameplate Picture (Y/N): N/A
- Water heater model name: Manufacturer F Water Heater, Manufacturer G Domestic hot water
- Type of water heater (Storage/Tankless/Condensing/Noncondensing): Storage
- # of Water Heaters: 4
- Regular Maintenance: yes, LOW NOX <30ppm certified by SCAQMD
- Appliance Age: 25-30 *Estimate
- Note the Hot water set point temperature (120 F for ASHRAE hospital guidelines): N/A
- Hot water pump recirculation control type: N/A

Other Categories

- Hot Water Pipe Insulation
  - Measure participation? - NO
- Hot Water Tank Insulation
  - Measure participation? - NO
- Low Flow Pre-Rinse Spray Valve
  - Measure participation? - NO
- Low Flow Showerhead
  - Measure participation? - NO
- Faucet Aerator
  - Measure participation? - NO
- Laminar Flow Restrictor - NO
  - Measure participation
- Other : Manager says not approached by utilities for EE participation-

Other Questions:

1. Is Laundry in house vs. Outsourced? Get detailed information on washing and drying if in house. Outsourced
2. Check if all appliances are certified as ENERGY STAR compliant: not all are. Only Manufacturer J ovens
3. Ask hospital engineers/facility managers about any equipment/comfort problems they are having? "If equipment fails we replace the part, minimal disruption to service", "in constant need of repairs"
4. Have they participated in any EE programs, if so which and when? Other questions relating to EE programs
    a. How much of a driver is it for end-users to reduce GHG emissions? (1-5)

1	2	3	4	**5**

    b. How much of a driver is performance improvements for the end-user? (1-5)

1	2	3	**4**	5

    c. How much of a driver is gas savings? (1-5)

1	2	3	**4**	5

5. How much of a concern is your gas bill (1-5)?

1	**2**	3	4	5

6. Is the hospital interested in upgrading appliances to more EE ones?

1	2	3	4	**5**

7. Barriers preventing EE equipment adoption
    a. How much of a barrier is HCAI (formerly oshpd) to implementing EE (1-5)

1	**2**	3	4	5

    b. How much of a barrier the hospitals allocated engineering Budget (1-5)

1	2	3	**4**	5

    c. How much of a barrier is the lack of maintenance personnel training (1-5)

1	2	3	**4**	5

    d. How much of a barrier is the uncertainty of technology performance by the end user? (1-5)

1	2	3	**4**	5

e. How much of a market barrier is incompatibility with existing systems for adopting newer EE gas appliances? (1-5)

1	2	3	4	5

f. How much of a barrier is the uncertainty of future codes/standards (1-5)

1	2	3	4	**5**

g. How much of a barrier is the lack of awareness of new EE appliances among designers and engineers (1-5)

1	**2**	3	4	5

Site #3
Building built/ major: 1998 renovations dates:

Note: Obtain photos and images of appliances if able to, specifically Appliance Energy Guide ratings and equipment plates. Confirm fuel is natural gas.

General Hospital System Questions

- Has it been RCxd?- NO

Overall Building Controls

- HVAC air distribution type? N/A
- Air and/or water distribution systems (Use of outdoor air and air distribution is big in hospitals, as much as 100% of it is outdoor) N/A
- DOA (dedicated outdoor air system) unit N/A
- Vent Hoods N/A
- Process Loads for Sterilizers N/A

Commercial Food Service Measures and Appliances to Survey

Capture general pictures of the kitchen


IMPERIAL
IMPERIAL


IMPERIAL
IMPERIAL


IMPERIAL


IMPERIAL
IMPERIAL
IMPERIAL


HEATING WATER SUPPLY


DOMESTIC COLD WATER
HIGH PRESSURE STEAM
LOW PRESSURE STEAM
CONDENSATE
LOW PRESSURE STEAM
2
3

- Combination Oven
  - Nameplate Picture (Y/N): Manufacturer K (4 total)
  - Usage (HPD and Days/week):7
  - Appliance Age:12
  - Regular Maintenance: Yes
  - Retrofits: N/A
  - Problems: N/A
- Convection Oven
  - Nameplate Picture (Y/N): Manufacturer L
  - Usage (HPD and Days/week): 7
  - Appliance Age:12
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Fryer
  - Nameplate Picture (Y/N): Manufacturer L Fryer (2x)
  - Usage (HPD and Days/week): 7
  - Appliance Age: 12
  - Regular Maintenance: Yes
  - Retrofits: N/A
  - Problems: N/A
- Undercounter Dishwasher
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): N/A
  - Appliance Age: N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Door Type Dishwasher or Flight or Conveyor Type
  - Nameplate Picture (Y/N): N/A
  - Usage (HPD and Days/week): N/A
  - Appliance Age: N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Gas Grill
  - Nameplate Picture (Y/N): Manufacturer L Gas Range

  - Models *Redacted*
  - Usage (HPD and Days/week):7 days
  - Appliance Age: 12
  - Regular Maintenance: Yes
  - Retrofits: N/A
  - Problems: N/A
  - Other

Space Heating Measures and Appliances to Survey
Capture general pictures of the boiler room

- Boiler
  - Application (heating, hot water, process or a combination): Combination
  - Reset/sequencing controls : recently added autoflame controls
  - Building level boiler controls N/A
  - Appliance Age: Claver brooks: 1955; 68 years old, Manufacturer C Boiler (25 yrs)
  - Nameplate Picture (Y/N):
  - Model name and Manufacturer: Manufacturer C Water boiler, and Manufacturer B Boiler
  - Steam/Hot water? 3 steam, 2 hot water
  - Condensing or Noncondensing?: Condensing
  - Regular Maintenance: Per manufacturer recommendation
  - Retrofits: 2013 Manufacturer C boilers retrofitted with Low NOx burner, in 2023 Manufacturer B boiler retrofitted with autoflame controllers
  - Problems: no
  - # of Boilers: 3
  - Economizer present? no
  - Add-on controls? no
  - Linkageless controls? No
- Furnace
  - Building level furnace controls N/A
  - Reset/sequencing controls N/A
  - Appliance Age: N/A
  - Nameplate Picture (Y/N): N/A
  - Model name and Manufacturer N/A
  - Condensing or Noncondensing? N/A
  - Regular Maintenance: N/A
  - Retrofits: N/A
  - Problems: N/A
- Other (Steam Traps) : No

Measure recommendations based on boiler study:

- Exhaust Vent Condenser present? N/A
- Energy recovery using a flash vessel? N/A
- Flash Recovery Equipment? N/A
- Dual returns and smart plate heat exchanger? N/A
- Boiler reset controls (HVAC) N/A

Water Heating Measures and Appliances to Survey
Capture general pictures of the boiler room (if separate from the ones above)

- **Water Heaters**
  - Nameplate Picture (Y/N): N/A
- Water heater model name: Manufacturer H
- Type of water heater (Storage/Tankless/Condensing/Noncondensing):Storage
- # of Water Heaters (2)
- Regular Maintenance: Yes
- Appliance Age:7
- Note the Hot water set point temperature (120 F for ASHRAE hospital guidelines):
- Hot water pump recirculation control type: N/A

Other Categories

- Hot Water Pipe Insulation
  - Measure participation?
- Hot Water Tank Insulation
  - Measure participation?
- Low Flow Pre-Rinse Spray Valve
  - Measure participation?
- Low Flow Showerhead
  - Measure participation?
- Faucet Aerator
  - Measure participation?
- Laminar Flow Restrictor
  - Measure participation
- Other

Other Questions:

1. Is Laundry in house vs. Outsourced? Get detailed information on washing and drying if in house. Outsourced
2. Check if all appliances are certified as ENERGY STAR compliant:
3. Ask hospital engineers/facility managers about any equipment/comfort problems they are having? n/a
4. Have they participated in any EE programs, if so which and when? Other questions relating to EE programs
    a. How much of a driver is it for end-users to reduce GHG emissions? (1-5)

1	2	3	4	**5**

    b. How much of a driver is performance improvements for the end-user? (1-5)

1	2	3	4	**5**

    c. How much of a driver is gas savings? (1-5)

1	2	3	4	**5**

5. How much of a concern is your gas bill (1-5)?

1	**2**	3	4	5

6. Is the hospital interested in upgrading appliances to more EE ones?

1	2	3	4	**5**

7. Barriers preventing EE equipment adoption
    a. How much of a barrier is HCAI (formerly oshpd) to implementing EE (1-5)

1	2	3	4	**5**

    b. How much of a barrier the hospitals allocated engineering Budget (1-5)

1	2	3	**4**	5

    c. How much of a barrier is the lack of maintenance personnel training (1-5)

1	2	**3**	4	5

    d. How much of a barrier is the uncertainty of technology performance by the end user? (1-5)

1	2	3	4	5

e. How much of a market barrier is incompatibility with existing systems for adopting newer EE gas appliances? (1-5)

1	2	3	4	5

f. How much of a barrier is the uncertainty of future codes/standards (1-5)

1	2	3	4	5

g. How much of a barrier is the lack of awareness of new EE appliances among designers and engineers (1-5)

1	2	3	4	5

Other notes: HCAI is a major healthcare challenge, need to meet seismic standards. R&D is costly

Would prefer equipment that doesn't require 24/7 labor/personnel to watch it

CO2 footprint is a concern from organization.

SME #4
Subject Matter Expert: Current Facilities Consultant for "University of California Hospitals"

Questions:

1. Is Laundry in house vs. Outsourced? Get detailed information on washing and drying if in house. Outsourced
2. Check if all appliances are certified as ENERGY STAR compliant:
3. Ask hospital engineers/facility managers about any equipment/comfort problems they are having?
   a. Definitely
4. Have they participated in any EE programs, if so which and when? Other questions relating to EE programs
   a. Contacted in terms of that, sme is not sure
   b. How much of a driver is it for end-users to reduce GHG emissions? (1-5)

1	2	3	4	5

   c. How much of a driver is performance improvements for the end-user? (1-5)

1	2	3	4	5

   d. How much of a driver is gas savings? (1-5)

1	2	3	4	5

High priority – certainly
"Sometimes tied to compensation"

5. How much of a concern is your gas bill (1-5)?

1	2	3	4	5

6. Is the hospital interested in upgrading appliances to more EE ones? Yes

1	2	3	4	5

7. Barriers preventing EE equipment adoption
   a. How much of a barrier is HCAI (formerly oshpd) to implementing EE (1-5)

1	2	3	4	5

- Should not be a barrier as long as they meet standards or requirements
- Delays the actual purchases
- Only time it's a barrier if there is something that is a structural issue and hasn't been oshpod approved.

   b. How much of a barrier the hospitals allocated engineering Budget (1-5) 5

1	2	3	4	5

   c. How much of a barrier is the lack of maintenance personnel training (1-5)

1	2	3	4	5

   d. How much of a barrier is the uncertainty of technology performance by the end user? (1-5)
      i. Probably not
      ii. Once they understand the need
      iii. Education for their staff (high turnover) as long as company provides educational need and support. - help open door pretty wide.
      iv. NEED is the first thing
      v. Facilities director is supposed to have a log for every piece of equipment, an age record.
      vi. CDC does a surprise inspection – look to facilities department and look at the log for gas appliances
         1. Many times hospitals fail – by healthcare law they need to but sometimes don't. They don't proactively look, budget is a problem. They are going to buy a new Xray machine over a boiler.

1	2	3	4	5

e. How much of a market barrier is incompatibility with existing systems for adopting newer EE gas appliances? (1-5)

1	2	3	4	5

f. How much of a barrier is the uncertainty of future codes/standards (1-5)

g. - very low

1	2	3	4	5

h. How much of a barrier is the lack of awareness of new EE appliances among designers and engineers (1-5)

i. Information is not lacking – given that engineers and facilities are part of larger groups, and they all get information from conferences,
ii. Biggest issue is the people that are willing to take the information and do something about it
iii. People issue. Especially in facilities – those who are stuck in their ways. Not understanding or fully embracing new technology.
iv. Human factor in there.
v. CEO- needs to act on this, not facilities.
vi. More energy efficient matter crucial for the long haul –vast majority are thinking day to day, not long term
vii. Labor shortages.
viii. Pound this information at the system at the corporate levels.

1	2	3	4	5

- Facilities departments are in house
- Stretched really thin in terms of engineers and staff
- #1 expense to every hospital is labor
- Labor shortage is a massive issue in facilities and hospitals

SME #5
Subject Matter Expert: Former hospital Facilities Director at 3 hospitals under the "Prime Healthcare Group"

Other Questions:

1. Is Laundry in house vs. Outsourced? Get detailed information on washing and drying if in house.

a. Prime healthcare hospitals – all outsourced

2. Check if all appliances are certified as ENERGY STAR compliant:

b. Price is an issue so they get fixed pricing for certain vendors, so they focus on that. Unless there is a cost savings with energy star appliances
c. Disconnect between the food service manager and facilities in some hospitals
d. Not sure what to ask for proper equipment.

e. Disconnect with coordinating

3. Ask hospital engineers/facility managers about any equipment/comfort problems they are having?
   a. Boilers were not too bad (retubed, welded)
   b. Often times neglected, ancillary issues with the boiler not the boiler itself
   c. Most problems with gas were in the kitchen.
4. Have they participated in any EE programs, if so which and when? Other questions relating to EE programs

Do participate through water saver solutions

d. How much of a driver is it for end-users to reduce GHG emissions? (1-5)

1	2	3	4	5

- never even a conversation more focused on saving fuel.

a. How much of a driver is performance improvements for the end-user? (1-5)

1	2	3	**4**	5

b. How much of a driver is gas savings? (1-5)

1	2	3	4	**5**

5. How much of a concern is your gas bill (1-5)?

1	2	3	**4**	5

- 100,000 cost savings, no regard
- Hospital politics

6. Is the hospital interested in upgrading appliances to more EE ones?

1	2	3	**4**	5

- Had 53 million dollars in new projects for remodeling
- Management issues

7. Barriers preventing EE equipment adoption
   a. How much of a barrier is HCAI (formerly oshpd) to implementing EE (1-5)

1	2	3	4	**5**

- Even the simplest forms of equipment replacement handled through HCAI
- Submittal process
- 8-10x more equipment cost for doing it in the hospital
- Bureaucracy
- Minimum to get emergency approval 6 months
- Reluctant to grant emergency permits at HCAI

b. How much of a barrier the hospitals allocated engineering Budget (1-5)

1	2	3	4	5

-this hospital was generous

c. How much of a barrier is the lack of maintenance personnel training (1-5)

1	**2**	3	4	5

d. How much of a barrier is the uncertainty of technology performance by the end user? (1-5)

1	**2**	3	4	5

e. How much of a market barrier is incompatibility with existing systems for adopting newer EE gas appliances? (1-5)

1	2	3	**4**	5

- Seismic incompatibility
- New water heater larger capacity (seismic as far as the anchorage, what is good 10 years ago is not acceptable)
- Incur more expenses

f. How much of a barrier is the uncertainty of future codes/standards (1-5)

1	2	3	4	**5**

g. How much of a barrier is the lack of awareness of new EE appliances among designers and engineers (1-5)

1	2	3	4	**5**

- Hospital definitely needs help with energy consumption
- -one hospital hired a guy to help with that.- cost cutting, water conservation, and energy savings
- Thermal storage tank (hasn't been operational for 10 years)
- -boilers are dated (gas fired steamed boiler) very dated
- Burners are dated

OPMs – preapproved
CDPH CMS guidelines, Accreditation guidelines, Joint Commission, State AQMD regulations
SoCal gas rebate models may not fit parameters that CMS has for heating in food service, different temperature for washing dishes, washing hands.
Serving temperature and food – joint commission as long as it meets parameters of preparing and serving those food.

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